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Fig. 1.—Sussex Trug Basket: side view.

Fig. 2.—End View.

Fig. 6.—Boards—A, Middle; B, Side; C, Top Side.

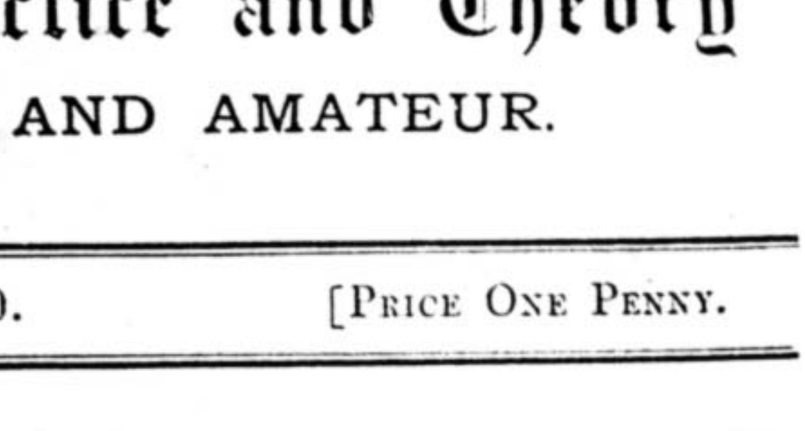

Fig. 3.—Shape of Rim—A, Section before Trimming; B, Ditto after Trimming.

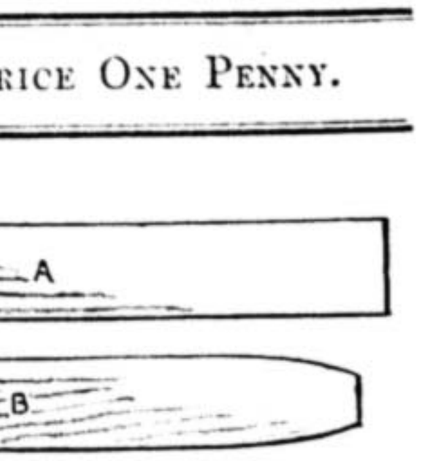

Fig. 4.—Shape of Handle.

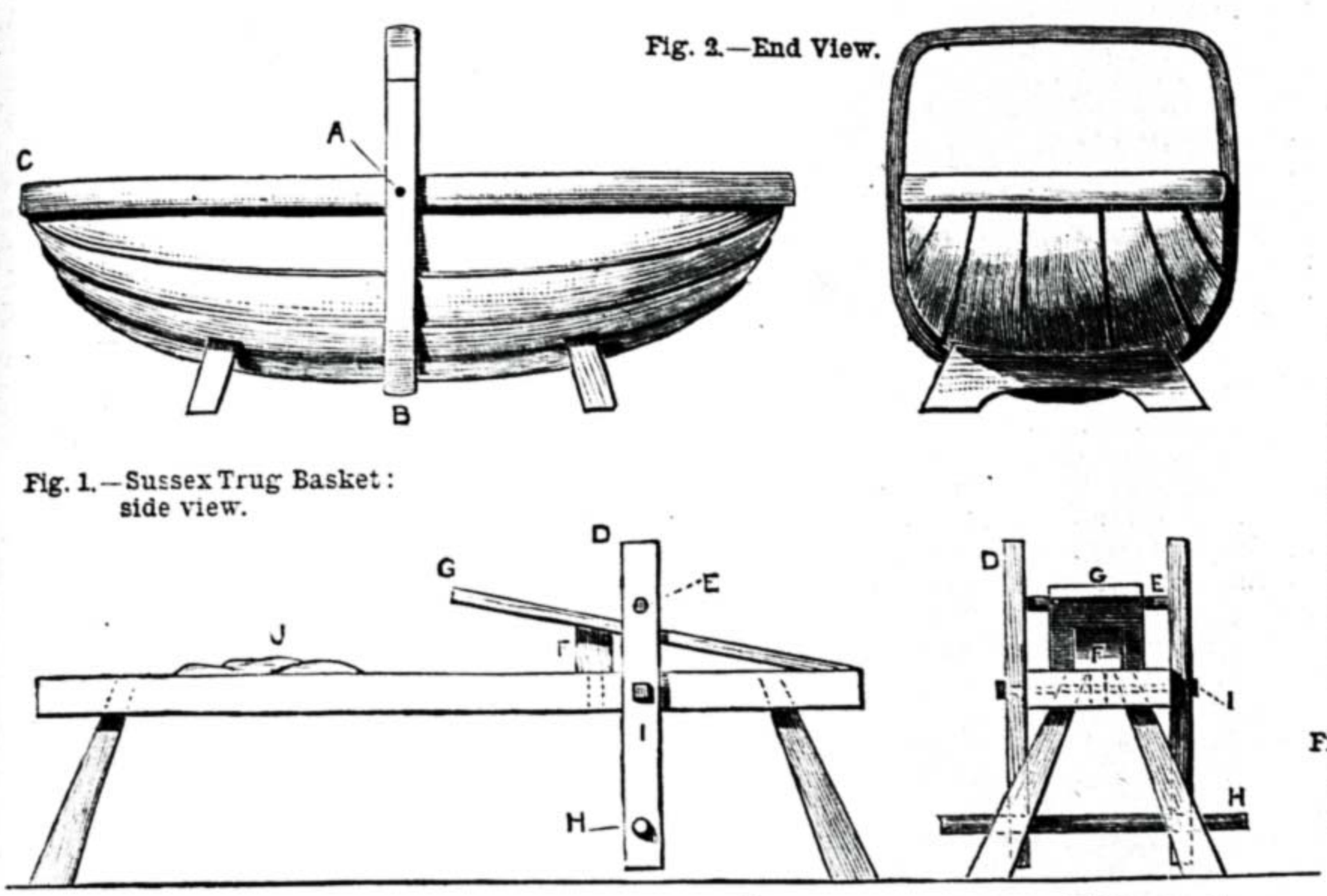

Fig. 7.—Shaving-Horse: side view.

Fig. 8.—Ditto: end view.

Fig. 5.—Shape of Foot.

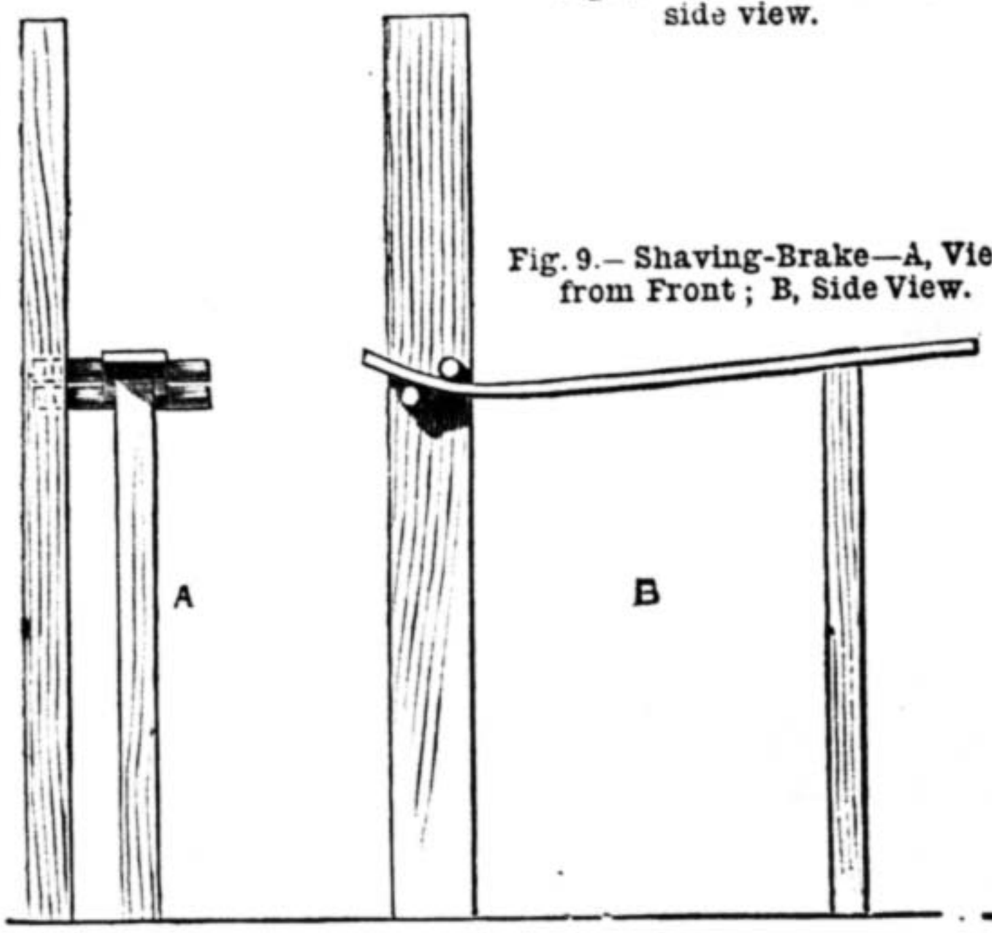

Fig. 9.—Shaving-Brake—A, View from Front; B, Side View.

Fig. 10.—Steaming Trough—L, Copper; M, Fire; O, Chimney; P, Stoke-hole; Q, Post: K, Steaming Box; N, Pipe conveying Steam to Box; R, Lid.

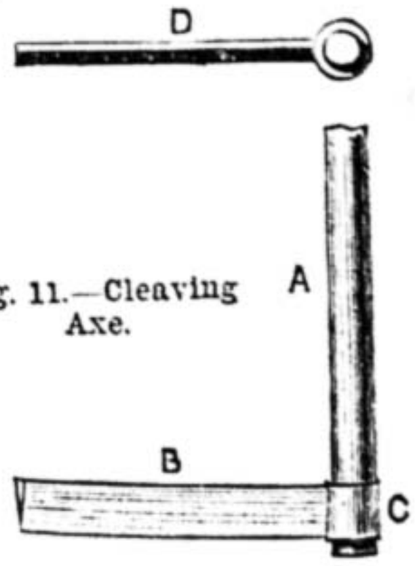

Fig. 11.—Cleaving Axe.

SUSSEX TRUG BASKETS: HOW TO MAKE THEM.

BY CHOPSTICK.

I HAVE no doubt that by far the greater majority of the readers of WORK, on seeing the above title, will exclaim, "And what are Sussex trugs?" If they will carefully follow my instructions, they will not remain in ignorance any longer. Before commencing the making proper, perhaps it will be advisable, by way of introduction, to describe what a Sussex "trug" is, and to what use it can be put. It is really a basket, but instead of being made of osiers, it is made of very thin wood. They were first invented in Sussex, and, I think, are not made anywhere in England except within a radius of ten miles of the original manufactory, which I must say is a matter for surprise, as to those who have always used them it is difficult to understand how anyone could manage without them. The uses to which they can be put are legion; the larger sizes are used in breweries, in coal-yards, in timber-yards, in gardens, and, in fact, everywhere; while the smaller sizes find a large sale at seaside towns for children; besides which some are made very ornamental, and are then used largely as ladies' work-baskets, flower-pots, etc. They are very durable; in fact, if not allowed to be continually wet, they will last a lifetime.

If there are any readers in search of something in which to make a start in business, this, I think, would be a good chance, as they would be certain to find plenty of customers, and the tools required are very

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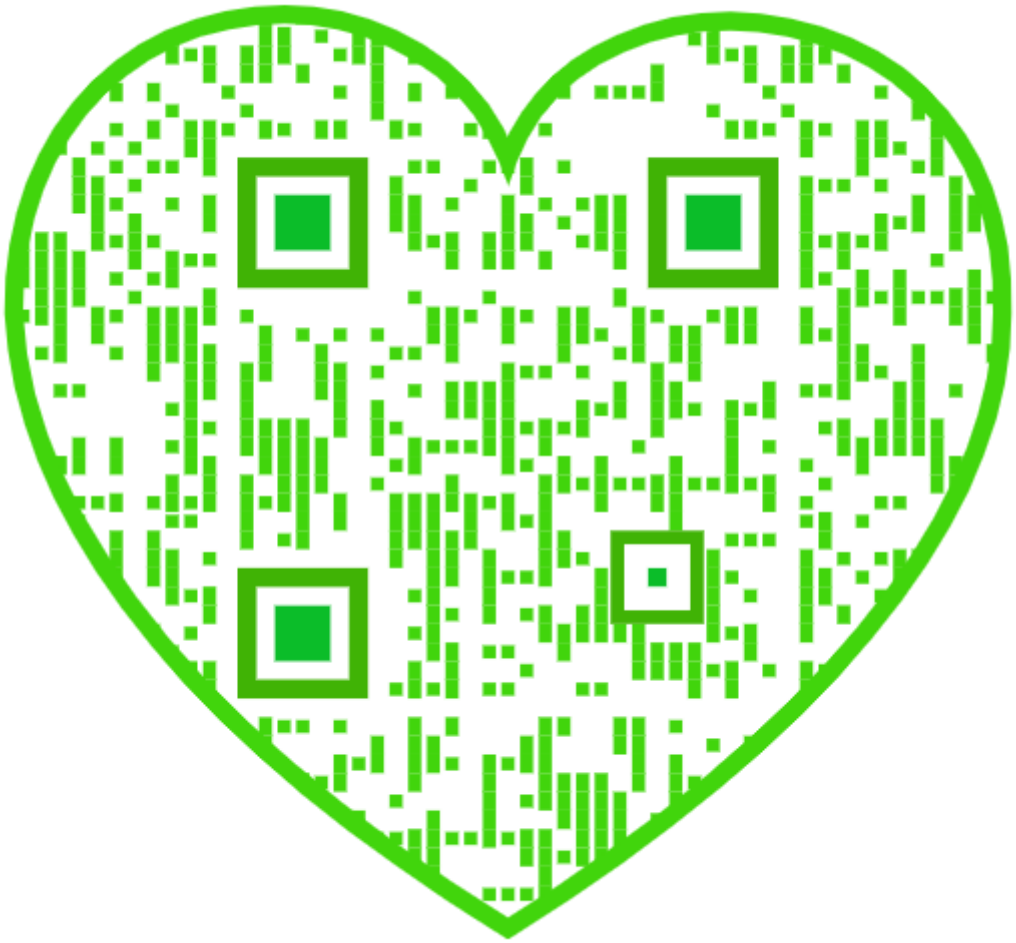

few, the timber cheap, and the trade easily learnt, which cannot be said of many things described.

I will first mention the tools required, which will have to be bought. The principal tool used is the drawing-knife, or, as it is called in some places, the draw-shave. We shall also want a hand-saw, a small axe, a cleaving axe, a hammer, and an old flat-iron; all the rest we can make ourselves. I will describe the most useful one first—that is, the shaving-horse (Fig. 7, side view, and Fig. 8, end view). To make this, we shall want a plank about six feet long and from ten to twelve inches wide—it is not particular to an inch. Into this plank, about six inches from each end, bore two one-and-a-quarter-inch holes, and drive a leg in each, so as to form a stool of the same height as a chair; be careful to bore the holes so that the legs spread well, so as to make it firm. Having got so far, the next thing will be two pieces of ash, or some other tough wood, two feet six inches long, about three inches by one and a half inches, bore two one-and-a-quarter-inch holes in each, six inches from each end, and a three-quarter-inch hole thirteen inches from the top end—these are the pieces marked D in the figures. We then want two round pieces to fit the largest holes, one three inches longer than the stool is wide, and the other nine inches longer still. These must be driven in tightly into the side pieces, so as to form a frame which will easily slip on the stool. Now bore a three-quarter-inch hole through the stool edgeways, one foot nine inches from one end, and, putting the frame on, pass a bolt through the sides of the frame and through the stool. We have now a stool with a frame swinging upon it. I should mention that the longest round piece should be at the bottom, and, if done as I intended, it will project four and a half inches each side, the reason for which I will explain in due course. The next proceeding is to get a piece of wood (any kind will do) ten inches long, and about four inches wide by three inches thick. This is the piece marked F in figures, and must be fixed in centre of stool, an inch or two nearer the long end than the bolt, before-mentioned, which the frame swings on. The best way to fix it is to tenon it through the top of stool and pin it; but any way will do so that it is firm. Having got the block fixed in position, it must be cut off on the bevel from five inches at the side towards the long part of stool, so that a board G, which should be six inches wide, will bed on top of block and fix to the short end. A glance at the side view in Fig. 7 will, I think, explain my meaning. Our shaving-horse is now complete, with the exception of the cushion to sit upon, J, which will require no explanation. Now to explain the method of using it. If we sit astride of our horse, and place the feet, one on each side, on the projecting pieces H, thrusting them forward, the frame swings on the bolt I, and clips the piece of wood we are shaving between the board G and the round piece E; and the more pressure we have to put on our work the harder our feet thrust forward, thus holding the work the tighter. I do not think anyone will fail to understand how to make and use the shaving-horse, and I may here mention that it is a very useful thing in any shop for many other things besides trug making.

The whole of the wood for the smaller trugs can be prepared on the shaving-horse; but those who go in for the larger sizes will require something else to shave the rims and handles on—this appliance is shown in Fig. 9, A being the end, and B the side view. It is simply a stump driven in the ground and two pegs driven into it, one a trifle higher than the other. The piece to be shaved is then put between the two and bent up to the top of a shorter stump, when the friction will hold it firmly. The whole affair, with a piece in position for work, is clearly shown in B (Fig. 9). The pegs and short stump should be about four feet from the ground.

The next piece of apparatus will only be required by those who go in for the largest sizes, or make in a large way to sell again. It is a steam trough for steaming the rims and handles, to make them bend easily, and also to keep their shape better. It is fitted up in connection with the common copper, or set-pan, which is found in nearly every house. In the figure (Fig. 10) L is the copper, M the fire, O the chimney, P the stoke-hole, Q, a stump to hold end of trough K, which is a water-tight box about six feet long and nine inches square, stopped at the end nearest the chimney, and fitted with a movable lid at R; a square tube N leads from the copper to the trough, and it will be plain to all that when the trough K is filled with the pieces of wood and the door R closed firmly, on the water being kept boiling for half an hour, they will get a good steaming, and will then bend as we want them. I do not think the steam trough will require any more explanation, especially as the smaller sizes can be boiled in the water, so no trough will be required.

Having now got all the tools we want, we will make a start at trug making proper. First as to the wood required. The trugs are formed of four parts, the rim (Fig. 3), the handle (Fig. 4), the feet (Fig. 5), and the boards (Fig. 6). We will take the rims and handles first: these are made from ash or chestnut poles about two inches in diameter—the straightest and most clear from knots are most suitable; these should be cut to lengths and quartered—that is, cleft through the middle—and then each piece cleft through the middle at right angles to the first cleaving; we have then four pieces in section like A (Fig. 3). We then shave off the sharp angle at the pith, and trim off any irregularities left from cleaving, and just take off all sharp edges; we have then four pieces something like B (Fig. 3) in section. The less we touch the outside the better, as that is where the strength is wanted in bending. The ends, for about six inches back, must be thinned down, so that the two will come together and form a neat joint, and look about the same size as the rest of the rim. The handles are made in exactly the same way. The shaving being done, the next thing is to steam them or boil them, as the case may be, which requires no instructions; so I will take that as done, and proceed to the putting together. This the young beginner will manage best by making a board of the same shape as a rim. We will make a trug about fifteen inches by eight inches, so all we want is a board half an inch less each way, with the corners rounded off; we can then bend the rim round edge of board and nail the splicing with about three or four nails, and it is done. The splicing should be in the middle of the long side, as at C (Fig. 3). The handle will be managed in the same way, only, of course, the board will have to be the shape of Fig. 4; and as the handle nails on outside the rim, the inside of it will have to be as wide as the outside of the latter, but it is not very particular to a quarter of an inch, as they will yield one to another. It may seem that an immense quantity of boards will be required for the different sizes, but after a little practice the workman will learn to dispense with them altogether, and bend both handles and rims by his eye alone, as they do in the trade. The handle and rim being ready, we must nail them together; to do so, slip the handle over the rim, holding it at right angles to same, and, laying the part where they intersect on a solid place, drive a nail right through as at A (Fig. 1); then turn the whole over and do the other side the same, clinch the nails inside, and the frame for our trug is done. We will now lay it on one side while preparing the boards (Fig. 6). These are made from sallow poles, which is a soft kind of willow; it is usually called "sally," so if you cannot get it by the name of "sallow" try "sally," when you will most likely succeed. The poles are cut off to the lengths required for the various sizes; the one we are about will require the boards twenty-one inches long; and it is then cleft out as thin as possible—the thinner the better—as there is then less shaving to do. After cleaving out with the cleaving axe, we lay them in a pile by the side of the shaving-horse, so that we can reach them without moving from our seat, and placing a piece in position on the board G (Fig. 7), we place our feet on the projecting pieces H, and then shave one side plain; then turn it over and do the other side the same, but a trifle round so as to make them thinnest at the edges; then turn ends and do it the same again, and our board is finished. They can be made to any of the shapes shown in Fig. 6, whichever will suit best, as it is a very accommodating trade, and they will all come in. Now, having finished shaving our stock of boards, we will put the bottom in our first trug. Select a board something like A (Fig. 6), and press it down in the framework and drive a nail into the handle at B (Fig. 1), then bend the board to the shape as shown in the figure, and nail again at C. Do the other end the same, and the first board is fixed, as one nail at each place is enough. Then take another board something like B (Fig. 6), and proceed in the same way, just allowing the board to lap over the edge of the first one, and so proceed on each side from the centre till the trug is finished. The last board on each side will have to be something like C (Fig. 6), and will most likely require fitting a little to the rim, which is best done with a sharp knife; the same tool is also used to trim off ends of boards after they are nailed in. It will be found that it takes about seven boards to complete the job, though, if they are of a good width, five will do it, and again, if very narrow, it will require more; but there should always be an odd number—that is, the same number on each side of the centre one.

All that we have to do now is to make and put on the feet (Fig. 5). These can be made from any odds and ends of either kind of wood, and are made about an inch thick to the shape shown, and nailed through from the inside, and our trug is complete; and, though it can hardly be expected that it will compare favourably with those made by the trade, there is no valuable timber spoiled, nor are there any insurmountable difficulties to encounter before we can make one that will both be a credit to the maker and also very useful in the household.

As there may be some of the readers of WORK who do not understand what I mean by a cleaving axe, I have given a rough

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sketch of one in Fig. 11. A is the handle of wood, B is the blade, and C the eye of the blade in which the handle A is fixed; D is a plan of the blade looking at the bottom. To use it, the piece of wood to be cleft is stood on one end, and the edge laid on it where it is to be split, the handle being held upright in the left hand and the blade struck on the thick part with a billet of wood until it is well in, when the handle is used as a lever and at once splits the wood. I do not think anyone can fail to understand my instructions for trug making, but if there should be anything not quite clear, I will at once explain it in "Shop" on being requested to do so. I have not said anything about the price of the timber, as that will naturally vary with different parts of the country; but it is very cheap anywhere, as sufficient could be bought for two shillings to make a good start with. I omitted to say that the proper nails to use are the stout wire with large flat heads, and the flat-iron before mentioned is to clinch them on; they can be driven in fearlessly, as there is no fear of splitting the wood.

If any reader would like a specimen trug basket to work from—and I cannot deny that it would be of great assistance to him—I have made arrangements so that one will be forwarded on receipt of twelve penny stamps; but as I do not think it right to give anyone a free advertisement, I will not give any address, but the Editor will no doubt forward all letters to me, and I will send them to the makers, when the trugs will be sent direct from the works. I will now conclude this short but, I hope, useful paper, and I hope that every reader to whom it applies will find trug baskets as useful as the writer has, both in the north and south.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

Paper Ruling and Account-Book Binding.

In this, my last paper on this subject, I have to treat of paper ruling and account-book binding.

The mere mention of this subject reminds me of some rather amusing remarks which I read not long ago in a contemporary, about the mysterious nature of account-book binding (vellum binding, I think it was there called). I have yet to find out where the mystery lies. Account books are ruled and bound in the open shop; there are no trade secrets about either of them. The very boy that sweeps the floor and takes charge of the glue and paste knows all about them. Certainly, a thing *is* always mysterious if one has no knowledge of it.

Paper ruling will require very little description, it is such a simple matter. All that is needed is a machine (which may be of very simple construction), a few pen points, inks of different colours—the most general being red and blue, or, technically speaking, "faint and red"—a few strips of flannel, some person to turn the winch handle, and a boy or girl to feed the sheets, and the thing is almost done.

The essential parts of a ruling machine, are a pen frame, and an endless band of cloth revolving on rollers, to carry the sheets of paper underneath the pens.

Of late years great improvements have been made in these machines. Formerly they were almost as slow in their movements as Caxton's printing press. The ruler sat on a stool at the front of the machine (if I can use the term for four bed-posts and two rollers), turning the handle with his right hand, and with his left catching the sheets as they were ruled, and spreading them all over the table to dry; and as these had to be gathered together and knocked up twice in the course of ruling both sides of the paper, and taking also into consideration the stops and starts—such as striking from the head-line, double pens running "blind," single pens running light—incidental to paper ruling, it will readily be understood that this operation was a very slow one indeed. I suppose he would be considered a smart ruler who could manage to put through a ream of faints in an hour. As a set off against this output, a little girl—or, rather, a machine tended by a little girl—can now rule one hundred reams on both sides per day of nine and three-quarter hours. This machine is of French manufacture. It has an automatic feed, and delivers the sheets after they have been ruled as evenly as when they were taken from the cutting machine. I do not recommend this French machine for general use, as it has been designed and constructed for a special class of work. To the wholesale stationer, however, it is a *sine quâ non*.

The best machine that I know of for general work, and one which I can confidently recommend, is that manufactured by Mr. John Shaw, Honley, near Huddersfield, and described as the "Single Striker Machine" (Fig. 29). The maker is very modest in setting forth the capabilities of his machine. He says in his circular: "This machine (speaking of his No. 3) is specially adapted for stop at head work, striking the pens automatically with far greater accuracy than by hand, and ruling ledger and invoice patterns with any number of stops with nearly the same rapidity as ordinary 'faint only.' It can be worked either by hand or power." Had I written the above description myself, I would have omitted the word *nearly*. The machine is also self-delivering. The striking arrangement will be easily understood from Fig. 31. On the end of the cylinder is a movable metal plate, lettered C in the diagram, around which are a series of thumbscrews, D, D. Small pieces of metal, B, B, etc., are let in between the plate and the end of the cylinder, and held in position by the screws. As the cylinder revolves, these pieces of metal cause the pen frame A to rise and fall, and thus the pens rule or stop as required. The cylinder appears set for three stops. The pens which are used with this machine are a little different from ordinary ruling pens, and it will be better to buy them than to attempt to make them. Indeed, it is hardly worth while for the ruler to make pens now, they can be bought so cheaply. These striking pens cost about one penny per point. Of course, the ordinary pens will do for faint and run through work, as in other machines. Ruling pens are made of thin sheet brass. The shape and style of them can be seen from Fig. 30.

Account-book binding—or, more properly speaking, stationery binding—includes everything, from the penny memorandum book to the massive ledger.

I will pass over the cheaper kinds of stationery, and in my remarks under this heading I will endeavour to give a detailed description of what I consider to be the best and most workmanlike method of binding an account book. I have a large experience in this class of work. The books bound under my supervision were generally pronounced to be better bound and more lasting (a necessary feature in account books) than those sent out by a firm in the same town, which enjoyed a world-wide reputation. I mention this so that my remarks may be taken at their proper value.

After the paper has been ruled, it is handed over to the female operator, whose duty it is to fold it into sections and prepare it for sewing. If the paper is what is termed hand-made, there will be two shades on every sheet: one side will appear blue and the other white; so to prevent a blue and white appearing together when the book is opened, the paper is "faced"—*i.e.*, two blue sides are made to face each other, then two white sides, and so on through the entire book. The ruler will have left four sheets of the paper which is to form the book unruled. These are for the end papers, and should be given to the forwarder to be made.

The joints may be of cloth, linen, or leather. Black glazed linen makes a good joint for general purposes. The joint is glued, and two sheets of the four already mentioned are laid upon the joint, about ⅛ in. apart from each other. The other two sheets are treated in a similar manner. Four pieces of marble paper are cut to the size, glued all over, and laid on to the edge

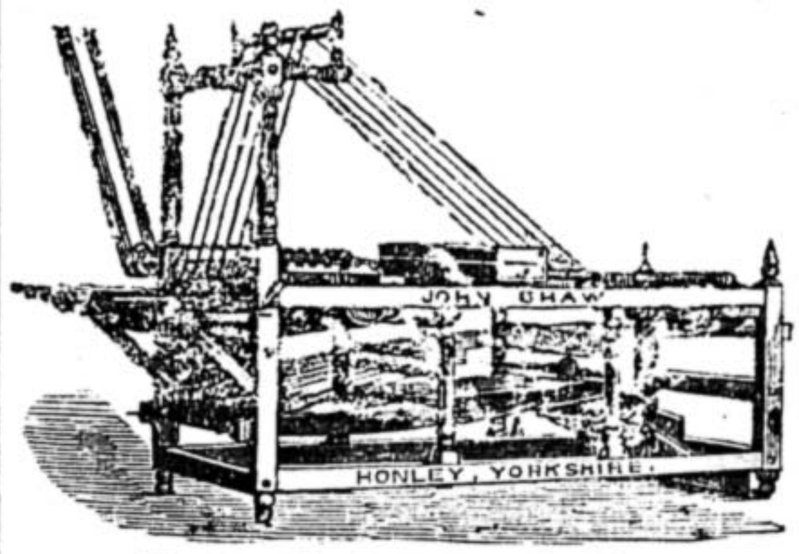

Fig. 29.—Single Striker Machine.

of the linen and rubbed down with the hand (nipping the papers in the press is superfluous), and hung up to dry. Meanwhile the folding of the paper has been going on, and it will be done up in three or four sheet sections, according to the make or thickness of the paper. The sections should not be too thick, for the leaves will start when the book is being rounded. Neither should they be too thin, for, in sewing, the back will swell, owing to the quantity of thread used. The first and last section should be lined on the outside with a strip of white calico. It is common with some binders to line the inside and outside of each section with calico. This may be necessary in special cases, but for general purposes it is not to be recommended, as a book thus treated will partake much of the guard-book appearance, and be very stiff to open. Given a good paper and a careful sewer, there need not be any fears of durability without the lining.

Account books are sewn on tapes, and there are no saw marks made in the back. For the class of work under notice a good strong twilled linen tape (called "binding" by us), of a grey colour, and sold in rounds, will be needed. Three or five bands, according to the size of the book, should be set up on the bench. Set up the bench by all means; I detest that slipshod method adopted by some binders of sewing on the table. This is done with the intention of saving time. It certainly does save the

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time of setting up the bench, but the time lost in keeping the bands straight, and now and again unravelling them from the thread during the operation of sewing, will far outweigh the time saved. Whence the profit? Strips of vellum are sometimes used as bands in conjunction with the tape for heavy books. I fancy I now see a smile on someone's face, and turn to ask the reason, when I am asked the question, How can you set up strips of vellum on the bench? Ah, very easy, my friend.

Join a piece of waste tape to each end of the vellum with a few stitches, lap the one end round the rail at the bottom of the bench and the other round the cross-bar at the top, and put a pin or a broken needle through it. "Where there is the will there is the way."

The thread must be well selected. A good linen thread 3-cord No. 18 is a very serviceable size. Really reliable thread for bookbinding purposes is manufactured by Messrs. Wm. Barbour & Sons, Lisburn, Ireland. I have used their thread in various sizes for both letterpress and stationery sewing for many years, and have every confidence in recommending it to the trade.

The thread used must be waxed, no matter who is the maker. The wax preserves it, and consequently it will wear better. Each section of the book must be sewn all the way up, and the needle must be brought out at the far side of the band, and introduced again at the near side, thus bringing the thread round the bands. The end papers will also have to be sewn to the book, and treated in the same manner as a section of the book. The slips, when the book is sewn, should project about 1½ in. on each side of the back.

The forwarder takes the book from the sewer, and his first duty will be to glue it up. The glue, like the thread, should be well selected. It should be bought from a house which has a reputation for honesty, if not for cheapness. Avoid "French Medal" glue, that turns frothy in the glue-pot; it has its uses, but one of them is not stationery binding. The glue should be thin, and tolerably hot when applied. It must be rubbed well into the sections. If the brush does not accomplish this satisfactorily, the thumb will, and should be used.

When it is dry, the fore-edge should be cut, and if the edges are to be mottled instead of marbled, do the fore-edge at this point. For a red and black mottle, use ordinary red and black inks; put the red on first, a good even coat, and allow it to dry, then with an open-holed sponge, daub on the black neatly and carefully.

The book will now be ready for rounding. A greater degree of roundness should be given to it than to a letterpress book.

The inside sheet of the end papers will require to be glued to the first and last leaf of the book. This should be done after rounding the back, and the book put in the standing press between tins.

I like the practice of pressing books with tins. It should always be done, especially in the case of account books. A greater degree of solidity will thus be imparted to the book. If the book can be left in the press over-night, so much the better.

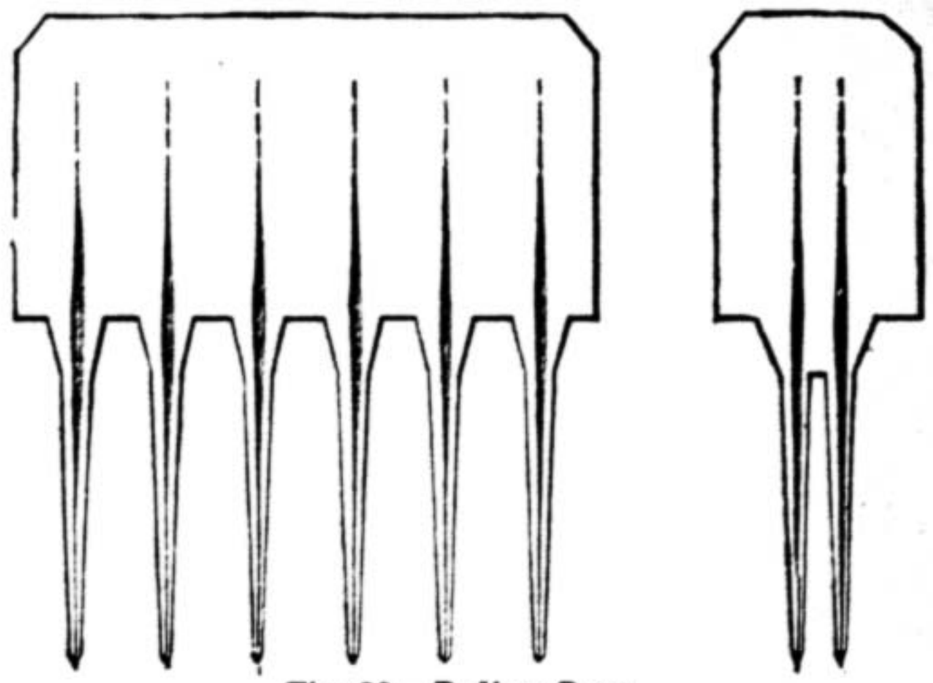

Fig. 30.—Ruling Pens.

In the morning, as soon as the glue is ready, get the book out of the press and line the back. Scraps of leather are kept for this purpose. The linings are cut to fit between the bands and the head and tail of the book. They should be long enough to extend about 2 in. on each side of the book. Glue the linings and the back of the book, and when attaching the lining, rub it well down with the folder to ensure it adhering well. The book should be screwed up in the lying press during this operation. In lining very heavy books, cover the entire back, the bands as well.

The next step in order will be to get the back made. This will have to be carefully measured for, so as to have it fit the book. Lay the book on its side with the back extending over the end of the lying press, and with a strip of paper measure the thickness of the back, allowing about ½ in. more on each side. Now cut two or three strips of thin hard millboard the breadth of the paper strip and a little longer than the book. Provide also a sheet of strong paper—"pressing" is the trade term for the stuff in general use. It is that greenish-grey paper used for the covers of memorandum books. Glue the paper and millboard strips and lap them up together, the millboard in the inside. According to the size and thickness of the book more or less paper and board will be required—in fact, the back should be almost as thick as the boards to be used for the sides. To allow time for the glue to set, cut the ends of the book, and mottle them as directed for the fore-edge.

It will be necessary to take great care in cutting the ends of an account book, as owing to the deep groove in the fore-edge, caused by the rounding of the back, the paper is apt to break at the corner. This can be avoided if the forwarder cares to take the trouble of padding up the fore-edge with waste paper.

A number of wooden rollers, with a sheet of stout paper or cloth tacked to them, are kept for the purpose of rolling the backs. Select one as near the thickness of the book as possible, take the back, which has been partially made and left while cutting the ends of the book, and heat it over the flame of the fire or a handful of burning paper shavings placed inside the fender at the fire-place for this purpose. It will turn quite soft with the heat and will be easy to roll. Place it lengthways against the roller, and roll it tight with the paper, which is attached to the roller lapped around it. Roll all backwards and forwards over the bench for a short time and leave it aside to harden.

When hardened sufficiently, it is pared at the edges and put upon the book. Be careful to have it close upon the back of the book and even at both sides: use the compasses, and gauge from the fore-edge. Glue the outside sheet of the end paper, and bring it over the back to the other side; repeat the operation with the other end paper, and rub it close into the back. Square the boards, which will have been made sometime previous, in the following manner. Two or three sheets of millboard are cut to the size and pasted together. The board intended for the inside should be thinner than the others, and only pasted about ⅔rds so as to leave a space for the slips and lining to go in, and thus attach them to the book; just before attaching them, make a cut in the lining with the scissors at each end on both sides of the book, and with the folder break the paper close into the back; this will admit the leather of the cover being turned in. Bend up the open piece of the board and glue it on both sides; put the slips into this space, leaving the piece which was cut with the scissors underneath. When both boards have been placed in position on the book, give it a nip in the lying press.

There is nothing special about the covering. Account books are covered in much the same manner as letterpress books, with the exception of knatching, which is done as soon as the cover is turned in. A pair of knatching boards—*i.e.*, boards with a projecting piece about the thickness of a small cane screwed along the top edge—is placed in the grooves made between the back and the boards on the sides of the book, and the whole screwed up in the lying press. After knatching, a cord is tied round from end to end and the heads are set. The setting of the heads should be carefully attended to, as when properly done, the book is much enhanced. It would be difficult to describe this process, so I will not attempt it. There should be, however, no hammer or folder marks on the edge of the book. When the cover

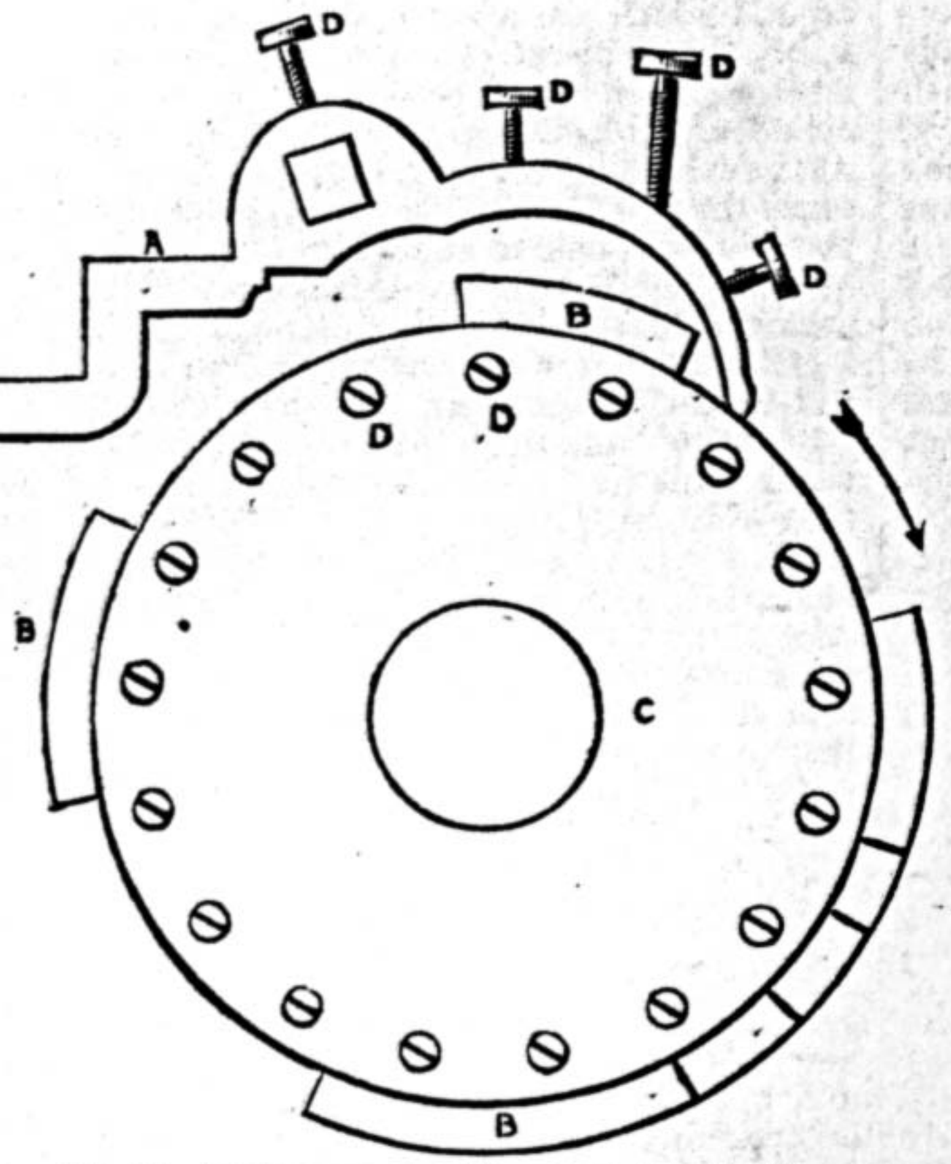

Fig. 31.—Striking Gear of Shaw's Ruling Machine.

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has become dry, the cloth sides are put on if the book is half-bound, and the end papers are glued up; a strip of thin board is placed close up to the joint on both sides of the book during this process: this acts as a lever, and causes the book to spring when being opened. After gluing up, the book is put in the standing press, and left there all night if possible, and the forwarder's work is practically done.

Account books, like letterpress, are covered in various styles. They are half-bound in sheep, goat, calf, morocco, Persian, and full bound in the same materials.

When covered in goat or calf, it is generally the flesh side of the skin that is on the outside. Full calf with green vellum corners rounded, instead of being cut square, is a nice style. Full calf, with Russia bands laced with white vellum, is very commendable for large books, but I do not think it adds so much to the strength as is commonly supposed. Since I have mentioned this style, let me caution binders not to leave the lacing inside the board, as when glued up, it presents a horrible appearance. Instead of this, open the board and lay it down on an iron block, and beat it well with the hammer on the inside so as to close the holes well up, and after drawing the lacing as tight as can be done, cut the laces off and beat again and again, until not a trace of roughness is seen upon the board.

In finishing account books, the ordinary leathers are treated as already described. Rough calf and goat are cleaned by rubbing with bath-brick. The black lines are put on with iron liquor carried in a sponge tied to the end of a piece of whalebone or stick, and held upon the roll as it is being run upon the backs or sides of the book.

Alongside with bookbinding in the workshop at present will be found operations of a very different nature going on; for example, there will be found "relief stamping" in colour, and gold and silver, envelope making, map and plan mounting, varnishing and gumming, photograph mounting, etc. Questions on any of these or kindred subjects will have my best attention in "Shop."

A PLAIN CABINET BOOKCASE.

BY DAVID ADAMSON.

CORNICE—PLINTH—DOORS—HINGES—DRAWERS—NAILING PARTS TOGETHER—SLIPS—MOULDINGS—EASING DRAWERS—SHELVES—FINISHING.

THE backboard of the recess hardly requires mention after what has been said about it, the only direction being that it should be just long enough to fit comfortably within the ends. As it lies behind the two pieces to which it is nailed, its width is not of so much consequence, provided, of course, that it is wide enough. For the sake of neatness, however, it will be better not to have it projecting above the upper board of the two, any excess being allowed to be behind the drawers.

Before saying anything about these, it will be as well to finish with the carcase of the bookcase, of which the cornice and plinth have still to be made and fitted. They are, however, so simple that the drawings showing them are almost self-explanatory.

Let us take the top first. Two pieces widening the ends here will be wanted. Their shape and size are so clearly indicated in Figs. 2 and 3 (page 362) that it will suffice to say of them that they must be exactly the same thickness as the ends to which they are attached, the fastening medium being glue.

The cornice itself consists of three members, of which the bottom one is the top board of the case: it, like all the other front edges of transverse pieces, having bevelled edges. The second, or main, portion of the cornice is merely a piece of board three inches or so wide, with its lower edge bevelled so that when it rests on A it projects slightly forward. Its upper edge is also bevelled to correspond, so that a narrow piece of inch stuff lies flat on it, and forms the top member. These two latter pieces must be cut to fit exactly within the ends through which they are nailed, and glue is used along the edges of each member. A few blocks behind them would support the glue, or a screw or two through A into the piece above it, and the same through the top rail, will have the same effect. With accurate workmanship,

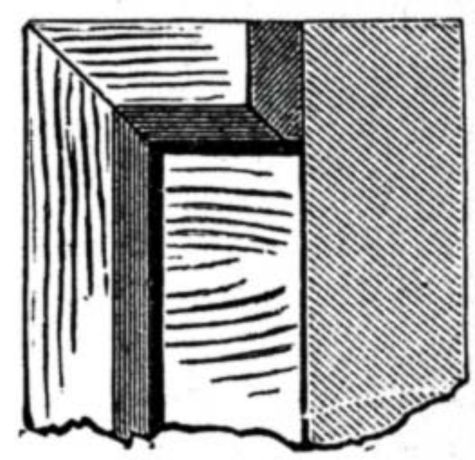

Fig. 9.

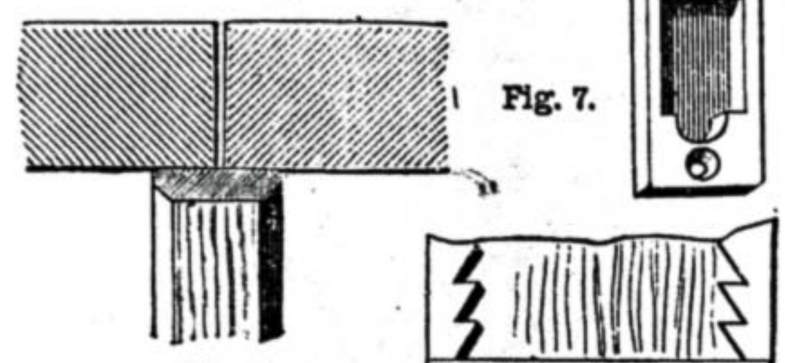

Fig. 7.

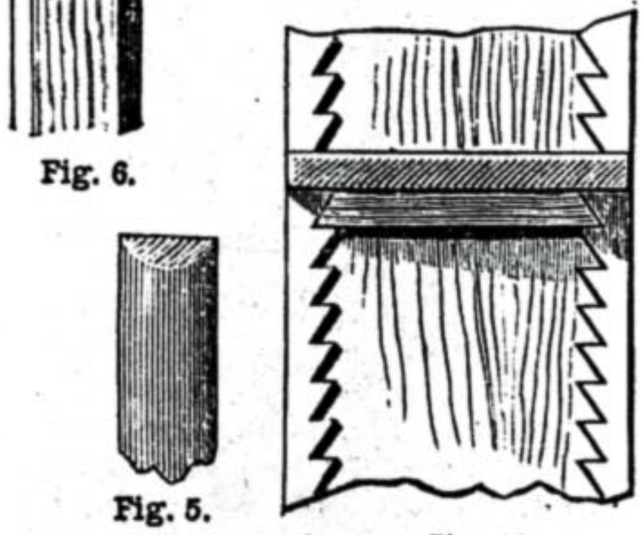

Fig. 6.

Fig. 5.

Fig. 10.

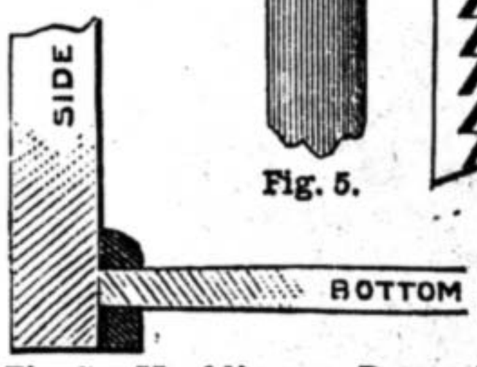

Fig. 8.

Fig. 5.—Moulding on Door. Fig. 6.—Alternative Moulding, showing Edges of Doors. Fig. 7.—Flush Bolt. Fig. 8.—Section of Side and Bottom with Slips. Fig. 9.—Corner of Drawer with Moulding. Fig. 10.—Rack for Movable Shelves.

glue alone ought to be enough—of course, in addition to the nails through the ends.

The plinth—if it may be so called—is constructed in a similar manner, but is even simpler, consisting only of one piece enclosing the space between the board E and the floor. The bevel which is shown on Fig. 3 at this part is, as will be seen, of considerable size, and gives relief to the front edge of the board E. Two short facing pieces are also used, as shown, and of course blocks may be used here as well as in other places, if they are considered necessary.

So far as the carcase is concerned, it merely remains to say that the front edges of the ends have plain beads run along them. As will be seen from Figs. 1 and 2 (pp. 361–2), the bead is stopped at the facing pieces, and also at the curved recess. The scratch will form the most convenient means to do the beading with, and as an article has recently appeared on the construction and use of this tool, the worker who may be unacquainted with it is referred to it for any particulars he may require. With regard to stopping the beads, it may be a useful suggestion to say that they should be formed before the facing pieces are attached, as these can easily be glued on afterwards, the bead running behind them.

The work is now ready for the doors and drawers. Enough has been said about the construction of doors when describing the overmantel to enable anyone to form these, but it may be said that the framing is 2¼ in. wide and the thickness 1 in. This, indeed, unless otherwise stated, is understood to be the thickness of which all this furniture is constructed. It will be noticed that the edges of the framing are stop-chamfered—*i.e.*, the bevel is stopped a couple of inches or so from the angle; but as all readers who are interested in carpentering work will see, in the articles entitled "Lessons from an Old Bureau," directions for this style of edging, nothing more need be said here. If preferred, the door framing may have a couple of beads corresponding with those on the ends "scratched" on them with perhaps less labour than is involved by chamfering. The panels of the lower door are quite plain, and are formed of ½ in. stuff, beaded in behind.

The upper doors are transparent—that is to say, the panels are of glass. Good window glass will do very well for the purpose, and is much lighter than plate, unless this happens to be the thin "patent" kind, which is, however, so expensive that it may be left out of consideration for cheap furniture. The glass door may be fastened in either with putty, like ordinary window panes, or be beaded in. The latter is certainly the preferable way, and the other is only mentioned in case it should be more convenient, as it is sometimes used in furniture glazing. The glass, especially if it is fastened in with beads, should be cut to fit as accurately as possible; for there is no occasion, as there often is with bevelled silvered plates or mirrors, for any spare space in the rebate. It will be found a good plan to send the door-frames themselves, instead of measurements only, to the glass-cutter's from whom the glass is bought. An exact fit can then be ensured without loss—or, at any rate, without loss to the maker of the bookcase—through any error in measuring or cutting.

The right-hand door of both the upper and lower cupboards has a bead scratched along its edge, but perhaps a better way will be to plant a small moulding on so that one half overlaps the other door when both are shut. For a plain bookcase like this the moulding should be as unobtrusive as possible, and nothing will be more suitable than either a plain "half-round," as in Fig. 5, or simply a strip with the edges bevelled off, as in Fig. 6, where the overlap is clearly indicated. The principal objection to the moulding is that unless fastened on very securely with glue and brads, it is apt to be torn away. Still, with ordinary fair workmanship, this risk is very slight, and may be avoided by partially sinking the moulding within a rabbet. As, however, this involves more difficult work than is contemplated in connection with this furniture, nothing more need be said about it.

Each door is hung with a couple of 2 in. butt hinges of good quality, for it must be quite understood that in describing this

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inexpensively constructed furniture there is no intention whatever of conveying the idea that anything will do. Though the construction is simple and departs in many ways from the recognised methods, there is no reason why, on that account, anything connected with it should be of inferior quality. In fact, I might almost say that because of its plainness everything about it should be good of its kind. On the left-hand doors a bolt of some kind is necessary to keep them closed when locked. The ordinary form of flush bolt will easily be recognised from Fig. 7. One for each cupboard will probably be enough, but if the door should have any spring, and not shut equally close at the bottom—a defect which, by the way, is sure to occur if the hingeing is not properly attended to—two bolts may be advisable. If only one be used—*i.e.*, one to each left-hand door—it will be better to place it at the top of the lower cupboard and at the bottom of the upper, so that the pins or bolts shoot into D and B (Figs. 2, 3, p. 362) respectively, where holes will be bored for them. The bolts are sunk in the edges of the doors, and should be of good width, as small ones are troublesome to work. The bolt holes in B and D may be protected by small brass plates, but with the ordinary precaution of always withdrawing the pin to its full extent no damage will occur to the woodwork. The exact position of the hole may be easily ascertained by smearing the end of the pin with gas-black or other material after the door is hung, and then forcing it against the wood above or below.

To prevent the hinges of the left-hand doors being strained by the doors being forced too far in, a small stop should be affixed inside the cupboards on D and A (Fig. 3).

On each right-hand door a lock, or some other catch, will be required. The proper kind is the cupboard lock, with "bolt shooting to left." They are let into the door frames and have a recess cut for the bolt to enter.

We now come to the drawers, which may be made in the usual way, but as this involves dovetailing and grooving—both of them processes which may not be practicable or convenient to those for whom these papers are intended—another plan may be suggested. Instead of dovetails, let nails be used to fasten the ends or side pieces of the drawers to the fronts and backs. True, the end grain of the sides will then be visible on the drawer fronts, but it may easily be covered, as we shall see.

The drawer fronts may be of 1 in. stuff, but the remaining parts will be better if considerably thinner—say $\frac{3}{8}$ in. or $\frac{1}{2}$ in. for the back and sides, while $\frac{1}{4}$ in. will be enough for the bottoms. In making a drawer in the usual manner, it does not much matter whether the sides or fronts are fitted first, but made as we are supposing these to be, it will be better to get the sides out first. They must be fitted exactly to the places which they are subsequently to occupy, rather tight than loose, so that they can just be forced in. When they have been properly planed up, and are in their places, the drawer fronts can be attended to; to have done so before, the length of these could not have been arrived at accurately. Now, with the sides it is simply a matter of cutting the fronts to fit tightly within them. The backs of the drawer should be of the same length as the fronts, but a little less in width—say $\frac{3}{4}$ in. It is by no means necessary that the drawers should extend quite to the back—indeed, it will be better if they do not —so that when cutting the sides this should be remembered.

The parts may now be nailed together, the nails being driven through the sides into the fronts and backs, and the heads punched in. The back, being narrower than the sides, may require a word of explanation about its fitting. As the bottom will be nailed under the back, but within the front and sides, it will be seen that space must be left. Let this space be $\frac{1}{2}$ in. or so; the reason for this excess, as it may be thought, will be apparent shortly. The top edge of the back will be below that of the sides a little. The precise distance is not of much consequence, as it is only necessary in order to facilitate easy action of the drawers by preventing the back coming in contact with C (Fig. 3). In the bottoms the grain of the wood must run from side to side, and not from back to front. They should be cut to fit closely within the sides, but in the other direction large enough to project about $\frac{1}{4}$ in. beyond the back. The bottoms might be nailed in, but it will be far better to support them on slips glued to the sides underneath them. These slips may be cut from the same stuff as the bottoms, and necessarily must not extend below the lower edges of the sides. With regard to cutting thin stuff like this, it may be a useful hint to the novice that it can be done very easily with a cutting gauge when the cut is with the grain.

These slips will form ledges for the bottoms to rest on, and by putting similar strips above these we come very close to the recognised way of fixing in drawer bottoms—that is to say, these are held within a groove. The slip may run along the front underneath the bottom, and will be advisable if this is only thin or intended to carry anything heavy. It will doubtless occur to the maker that the slips if used inside the drawer will look better if rounded off, as they are seen to be in Fig. 8, which represents, in section, part of a side and bottom fitted. The drawer bottom only requires gluing in front, as if not fixed elsewhere it has an opportunity of contracting without splitting. This it would be almost sure to do, unless the stuff is exceptionally dry, if it were bound at both back and front. After a time, if it shows no sign of shrinking further, a nail or two may be run through into the back. We have still to hide the end grain of the sides where they abut in front, and in covering them it may be satisfactory to know that the means used will be of advantage to the appearance.

Any kind of plain moulding will do for the purpose, but it should not be too large, and to harmonise with the general design it should be plain and simple. In fact, to call it a moulding is to give it a dignity to which it is hardly entitled, for it is merely a plain strip of wood, say $\frac{3}{4}$ in. wide—or at any rate a little wider than the thickness of the sides—and $\frac{1}{4}$ in. thick, with one edge bevelled off. It is planted on all round the drawer fronts, the corners being mitred. If the moulding is very little wider than the thickness of the sides—as end grain is not a very reliable foundation to attach anything to with glue—a few needle points may be used with advantage. Snapped short off, they will be scarcely, if at all, perceptible afterwards. To make this part of the work clear, Fig. 9, representing a corner of the drawer front showing the mitre and section of the moulding, is referred to. A stop must be fixed on the bearer or board on which the drawer rests, to prevent it being pushed too far in. A thin slip of wood, which allows the drawer bottom to pass over it, and with which the front comes in contact when the drawer is driven home, is not only the usual way, but the simplest.

The drawers will still require "easing" before they will run easily, but it will be better to let them stand a bit, and give them every chance of shrinking. They may shrink so much that no easing will be necessary. If it is, rubbing the sides or ends both on the outer surface and the upper and lower edges with glass-paper, or at most a shaving or two taken off with a plane, will probably be all that is required to make an easy fit. Nothing is more annoying than a tightly fitting drawer, unless it be one that is faulty in the opposite direction. A drawer that requires "humouring" before it can be closed or opened is so great a nuisance that no care which may be bestowed on this part of the work should be grudged. Although the drawers be made as described, there is no reason whatever why they should not run as easily as any of the best of the orthodox construction. With the remark that a brass handle will be required for each drawer, we have done with them, and may turn our attention to a very indispensable part of the work: viz., the shelves and their fittings.

It goes without saying that movable shelves are desirable in a bookcase, and whether strictly necessary or not, these pieces of furniture are generally provided with them. Those who do not require them will not need to be told that the shelves can easily be nailed, but directions could hardly be considered complete without showing how shelves may be movable and fixable at various heights. The arrangement is by no means a complicated one—or rather, I should say, arrangements, for there are several. It will, however, be unnecessary to do more than describe one of them, the common ordinary rack. By this method two pieces of wood—$\frac{1}{2}$ in. thick by 1 in. wide, will do very well—with serrated edges, are stuck from top to bottom on each end of the cupboard in which the shelves are to lie: one of them just behind the door and the other right against the back, each pair being quite parallel. For each shelf two bearers will also be required, the ends being bevelled off to fit within the notches on the uprights. On these bearers the shelves rest. The arrangement is shown in Fig. 10, where the section represents a shelf supported on a bearer fitting between two of the notched pieces. To make these, get out four pieces of wood of the required size and fasten them together with a screw, or by a nail or two, which can be removed, side to side, so that the edges form the top and bottom of what is practically a solid block. At regular intervals of, say, 1 in. to $1\frac{1}{2}$ in., draw a line across the edges on one surface, using the square as a guide, then on one or both of the outside surfaces, either with the gauge or otherwise, draw a line from end to end about $\frac{1}{2}$ in. from the marked face. With the saw cut down at each of the transverse lines to the other, and when this has been done it only remains to cut away the waste either with chisel or saw, and on separating the pieces we have four exactly corresponding with each other. A little trimming-up may be necessary, but it will not be much, as if the bearer fits within any two of the spaces, it will probably do so in all.

The shelves themselves must be good stout stuff, certainly not less than 1 in., or they will bend beneath the weight of large books; but of course a good deal depends on the length of the shelves. For those of 4 ft., however, or thereabouts,

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intended for large books, they must not be thinner than stated. They are merely plain boards with notches cut in each corner to allow space for the racks, so that no directions can be necessary. In case some readers might wish to have leather edging, it may be said that this will be considered when dealing with an open-fronted dwarf bookcase. In the present one, as the books are protected behind glass doors, no edging is necessary, and superfluous ornamentation does not form part of the scheme. Three movable shelves are shown in the drawing, and they will probably be considered enough, but of course everything depends on the size of the books, and there is no reason why fewer or more should not be made if desired.

In the lower cupboard one shelf across will be most convenient if this part is to be used for general purposes; but here, again, each must decide for himself, not only about the number, but whether they are to be fixed or movable.

The cabinet-maker's part of the work is now completed, and however crude the construction appears, I may say, as some encouragement to those who hesitate on that account to make up a bookcase—or, indeed, any of this easily made furniture—that the one from which this description is written, and from which it differs only in very unimportant details, was made some ten years ago, long before this series of articles was contemplated, and that it now looks down on me as I write, sound and strong (but I am bound to say not quite so fresh-looking) as the day it was made. To the readers of WORK I impart the secrets of its construction, and I do not think any, excepting those who are well accustomed to examining such things, would imagine the handsome, though plain, ebonised bookcase is formed as it is. One Art man went into raptures over it the first time he saw it, but then, like a great many of his kind, he was only a theorist, otherwise his opinion might have been of value. Still, it shows that even this easily made furniture need not be so badly put together that the casual observer is struck with its departure from ordinary constructive methods.

But perhaps someone may suggest that being made all in one carcase, the bookcase is rather unwieldy and awkward to get in and out of a room in the event of removal. Well, there is no denying that it might be inconvenient sometimes, but rather than describe it in an imaginary form, I have taken it as it stands, and for the benefit of those to whom its size may be an objection, I may give, as a closing suggestion, that it can easily be made in two carcases, the lower one ending at the top of the recess. The bookcase proper will then rest on a board covering this, the two parts being screwed together. If the joint on the ends be considered unsightly in itself, it can easily be covered with a thin piece of moulding or beading, such as that described for the drawer fronts.

A FEW HINTS ON CYCLE RIDING, PEDALLING, ETC.

BY P. B. H.

IN a former paper I described by sketches and letterpress some of the important points necessary to recognise a good from a badly designed machine. In the present one I shall endeavour to give to learners a few useful hints on riding, pedalling, etc.

The first thing needful, after having bought a machine, is to learn to ride it. In mounting a tricycle no difficulty will be found, as no balancing is necessary, but such is not the case with a bicycle, in learning which the balancing is one of the greatest difficulties; and especially is this the case in an ordinary, where it is at first almost compulsory to have the assistance of some friend to help and steady the machine, as when gaining the seat, which in this style of machine is so high, the learner is so liable to be thrown over the handles into the road, until he has gained some knowledge of its peculiarities by repeated attempts at mounting. In this latter case the assistance is principally necessary to save the learner from falling forwards when mounting the seat, and not for teaching the balancing; the sooner this aid can be dispensed with, and the rider left to his own resources, the sooner he gains confidence, and therefore learns to ride. In a safety machine it is almost impossible to be thrown head-first over the handles; and as this eliminates one of the greatest dangers to learners, friendly assistance is not so much a necessity, and, as I have remarked, the sooner aid is dispensed with the sooner the learner becomes proficient; therefore to all learners of a safety I give this advice: "Commence and learn without any assistance whatever."

The method I employed was as follows: I found a quiet country lane with a very slight decline in the road, the decline being so slight that the machine needed scarcely any exertion to start it, and it was not so great that the machine would increase its velocity by gravity when once started. At the top of the decline I made a mark, to which I brought the front wheel of the machine. Then with one foot on the step, and holding the handles firmly, while making no attempt to gain the saddle, I pushed off, only endeavouring to keep my balance on the step as long and as far as I could, and when I could go no further I learnt to jump—or at first, I might say, tumble—off as easily as possible, which is a very important factor, and you will find it will well repay some trouble in learning. After every dismount I brought the machine back to the old mark, trying every time to get farther without a fall than on the preceding trial. In about ten minutes I accomplished the balancing so well that I could reach the seat of the machine. The next difficulty to a learner who has not even ridden a tricycle before is to find and catch the revolving pedals without looking, and to keep them when found, as most of the attention is necessary to keep the machine balanced and away from any obstacles in the road. Having once succeeded in gaining the seat and command of the pedals, all the difficulties are overcome, and practice is all that is necessary to ride with confidence. Any learner who will rely on his own powers, and will proceed as above, will learn far quicker than if he has anyone holding the machine for him.

On the supposition that the learner can mount and ride his machine successfully, I shall now give a few hints on pedalling, which, next after the position of the body on the machine, goes a great way towards making a graceful rider.

Most readers of this paper will know that in single cylinder engines there are two dead points in each revolution of the crank—that is, where the steam in the cylinder has no tendency to turn the crank round. There are a great many riders who assume this of the bicycle crank, but to a good pedaller, and using the ordinary crank, there are no dead points, as power can be applied by each foot to turn the crank for almost ¾ of a revolution—that is, some time before the pedal reaches the top of its stroke and some time after passing the bottom, as shown by darkened line in Fig. 1, though fifty per cent. of the riders only apply pressure to the pedals for the distance shown by darkened line in Fig. 2. In this case there is a dead space (if I may use the term), not a dead point—that is to say, in each revolution both the right and left pedals alternately pass through a space (A, Fig. 2) equal to about fifteen degrees without any power whatever being applied, the machine during these intervals being carried forward by its own previously acquired inertia.

This circumstance alone accounts for a great amount of the jerky riding seen on the roads, and especially noticeable when the rider is climbing a hill.

In the former of these two cases more use is made of the ankle, and this is the more elegant way of riding. It takes some amount of practice to pedal nicely in this manner, but the trouble is well repaid.

The correct position of the foot on the pedals is shown in Fig. 3. In Fig. 4 I have shown by a skeleton diagram eight different positions of the foot in making one complete revolution of the crank. The length of the foot in Fig. 4 is proportionate to the length A in Fig. 3. The sole of the boot resting on the pedal I have assumed, for simplicity, forms a circle. The eight positions taken by the crank I have marked 1, 2, 3, etc.; the corresponding positions of the point representing the heel I have marked *a*, *b*, *c*, etc. The point A represents the thigh, and the numbers at B represent the path and positions of the knee for the corresponding positions of the heel. When the rider is making the proper use of the ankle, the point representing the heel follows an elliptic path (Fig. 4); the ellipse, however, being slightly flattened below. It will thus be seen that by inclining the foot to the horizontal by making use of the ankle, and thus preventing the foot slipping while it travels from 4, the assumed dead point, to 5, and also when passing from 7 to 8, the other assumed dead point, a certain, though small, amount of work can be applied in a backward and forward direction respectively. This force, though slight, if applied regularly, adds greatly to the smooth running of the machine, and also diminishes breakages, as all irregular strains tend to increase these latter. I have also endeavoured to indicate graphically by arrows the direction, and also by the numbers of the feathers attached to the same the average amount of power which should be applied through certain spaces. The three feathers indicating full power, the two feathers ⅔ full power, and the one feather ⅓ full power: when I say ⅓, ⅔ full power, I mean to say that the average power should be ⅓, ⅔, etc., in the spaces so marked, as it will be easily seen the power is only just commencing to be applied at 7, gradually increasing to 8, and onwards to 3, when it gradually diminishes. From the diagram it will be seen that when the right foot is travelling from 1 to 3, full power is being applied just when needed, as the left foot would then be travelling from 5 to 7, when no power can be applied; again, when the right is travelling from 3 to 4, exerting ⅔ full power, the left goes from 7 to 8, exerting ⅓ full power; and

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again, when the right travels from 4 to 5, exerting ⅓ full power, the left goes from 8 to 7, exerting ⅔ full power; and when passing from 5 to 7, exerting no power, the left passes from 1 to 3, exerting full power. In this manner the two combined pressures of the right and left feet together equal full power, and so an equal pressure is kept on the crank, chain, and driving wheels, thus keeping a very regular motion; any irregularities in the application of the power only tend to knock the machine to pieces. Pedalling, and at the same time making good use of the ankles, is difficult to a learner, but when once acquired it is the best and nicest method.

One of the greatest drawbacks to all cyclists, but especially to learners, are the hills to be encountered; and I have no doubt whatever that a great many beginners give up in disgust when they find them so hard to climb. The reason is that they never consider if it is worth the expenditure of power required to surmount it; but seeing some older riders doing it, they think they should go and do likewise, and ride blindly at it instead of dismounting when it gets too hard to ride without over-exertion. When a rider comes to a somewhat long hill, if he cannot increase his speed on it without extraordinary exertion, he should dismount and push the machine up it.

If you meet with a short sharp ascent of about twenty yards long, and if there is an incline down to it, then it is as convenient to ride sharply at it and surmount it on the machine, as the trouble of dismounting and remounting would equal the extra exertion required. But in general, if you cannot ride gently up to a hill and keep on at a uniform pace up it, then get off and push your machine up, as otherwise, if the road is hilly, you will soon be worn out and disgusted. Of course, climbing a hill becomes easier the more practice you have, so that if you persist for a short time the difficulties gradually become less, and the hills easier to ride.

The question is often asked by cyclists: "How is it that it is so much easier to dismount and push your machine than ride it up a hill?"

I will endeavour to explain it without any mathematics. From children we have been taught to walk, and we have grown so accustomed to this manner of progression that we do not really take into account the work we are doing. What child, after skipping, running, and jumping about all day, if told it had been working hard, would believe it? And yet such is the case.

You often, when out walking, on arriving at the top of some eminence, hear the remark: "That was rather a stiff hill," yet the speaker does not consider what work he has been doing; probably if he thought he had been working he would have remained at the bottom. Suppose a man riding a bicycle up a hill, and that it was geared so that the rider could go at the same pace as when walking with the machine, and that at that speed the machine could be balanced; then in these two cases the same amount of work is being done—that is, the man is lifting his own weight and the weight of his own machine to the same height—viz., the top of the hill—in the same time. The weights are, however, being lifted by two quite different methods. In the one case he is lifting the body by walking, which he has grown so accustomed to that he does not consider it work, so that really he only seems to be raising the weight of his machine. In the other case, in which he is seated on the machine, he is raising himself together with his machine in a manner and by muscles to which he has not grown so accustomed, and which are used in an unaccustomed manner. This is the reason the work seems to be so much greater, though the same amount is being performed.

In order to give the reader some idea of the amount of mechanical work which the various parts of the human body exert, it will not be out of place to give the result of some interesting calculations made by Dr. Buchheister on the work done by certain mountaineers during their ascensions. Suppose a man of 165 lbs. weight mounts to a height of 2,187 yards, the amount of physical work which the doctor calculates he does in the five hours duration of the ascent is ⅙ of a horse power.

From this result it will be seen that climbing a hill without any impediments whatever, and in a way we have been so accustomed to from infancy that we do not consider it work at all, is by no means an easy task. Therefore, what must it be at first when we commence riding a bicycle up an incline by means of power applied by the legs in an altogether unaccustomed manner, and making use of muscles which up to this time have probably had very little on them at all, and the weight of the machine—40 lbs.—has also to be taken into consideration?

Never buy a machine on the recommendation that it is so light if it is your intention to use it on the roads, as most probably breakages will make you disgusted with your purchase.

Never try to overtake riders who may be ahead or have ridden past you on the road. Keep up a regular pace, and vary this as little as possible, with the exception that after a meal you should always ride slowly to commence with, and walk up even the moderate hills for about twenty minutes, till your food has partly digested. On a journey, say of some seventy or eighty miles, you will see young fellows bent almost double rushing along as if their lives depended on the speed, and yet the slower rider will be the faster in the end, as the racing speed cannot be kept up without drink. This entails a stoppage: the drink invigorates you for about five or ten minutes after mounting, but you then become more languid than before the so-called refresher. I seldom drink in a journey of this length, except at a meal, which I should take when about half the distance was covered; and if the weather was very hot I should have an orange or some other seasonable fruit on the road. This will be quite sufficient to quench one's thirst.

A great deal could be written on the subject of cycling, but I hope that these few remarks will be acceptable, and afford some hints to the readers of this paper.

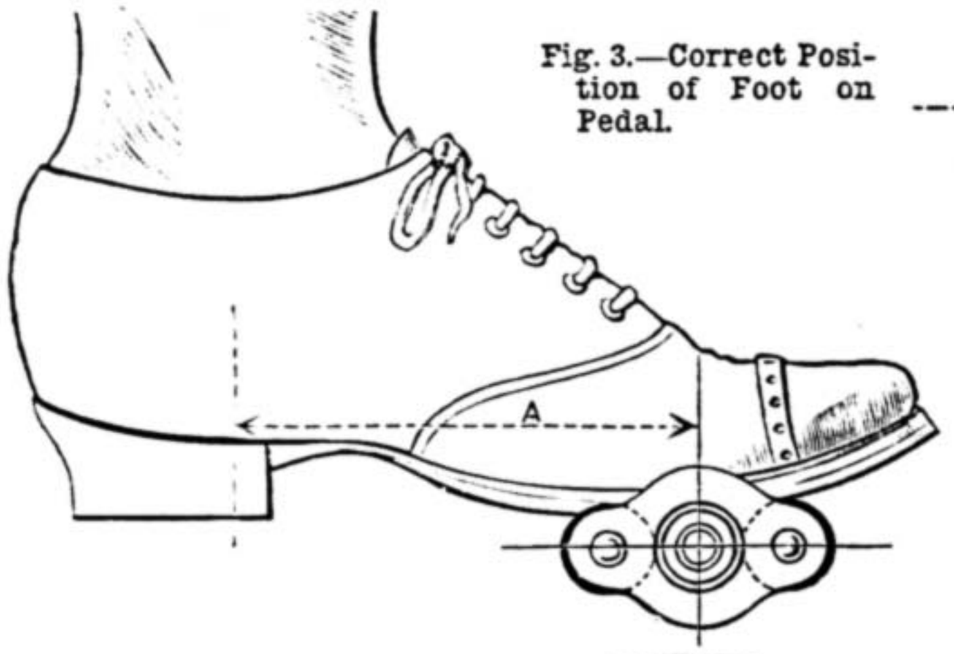


Fig. 3.—Correct Position of Foot on Pedal.

Fig. 1.—Application of Power to Crank without Dead Points or Space.

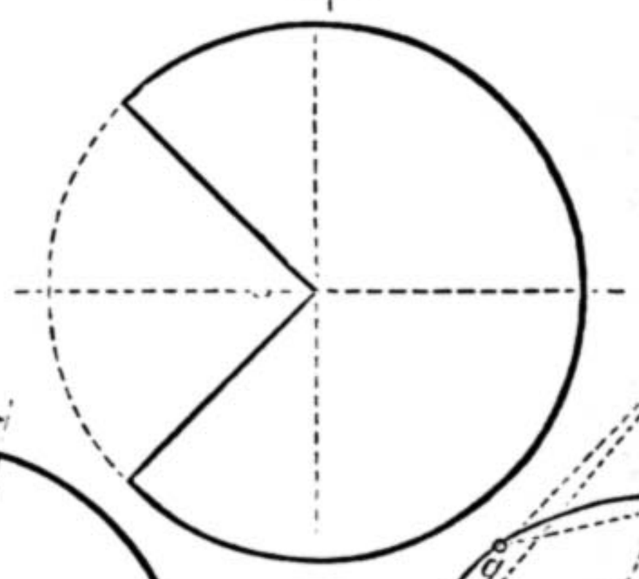
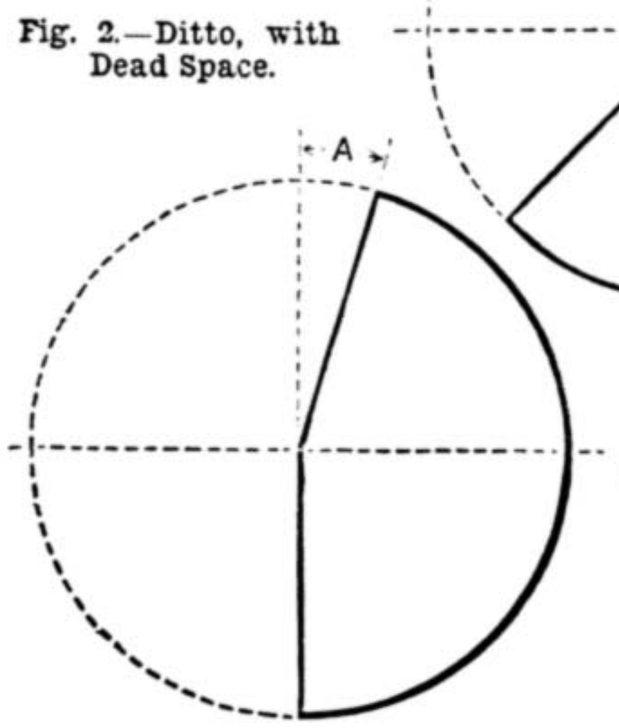


Fig. 2.—Ditto, with Dead Space.



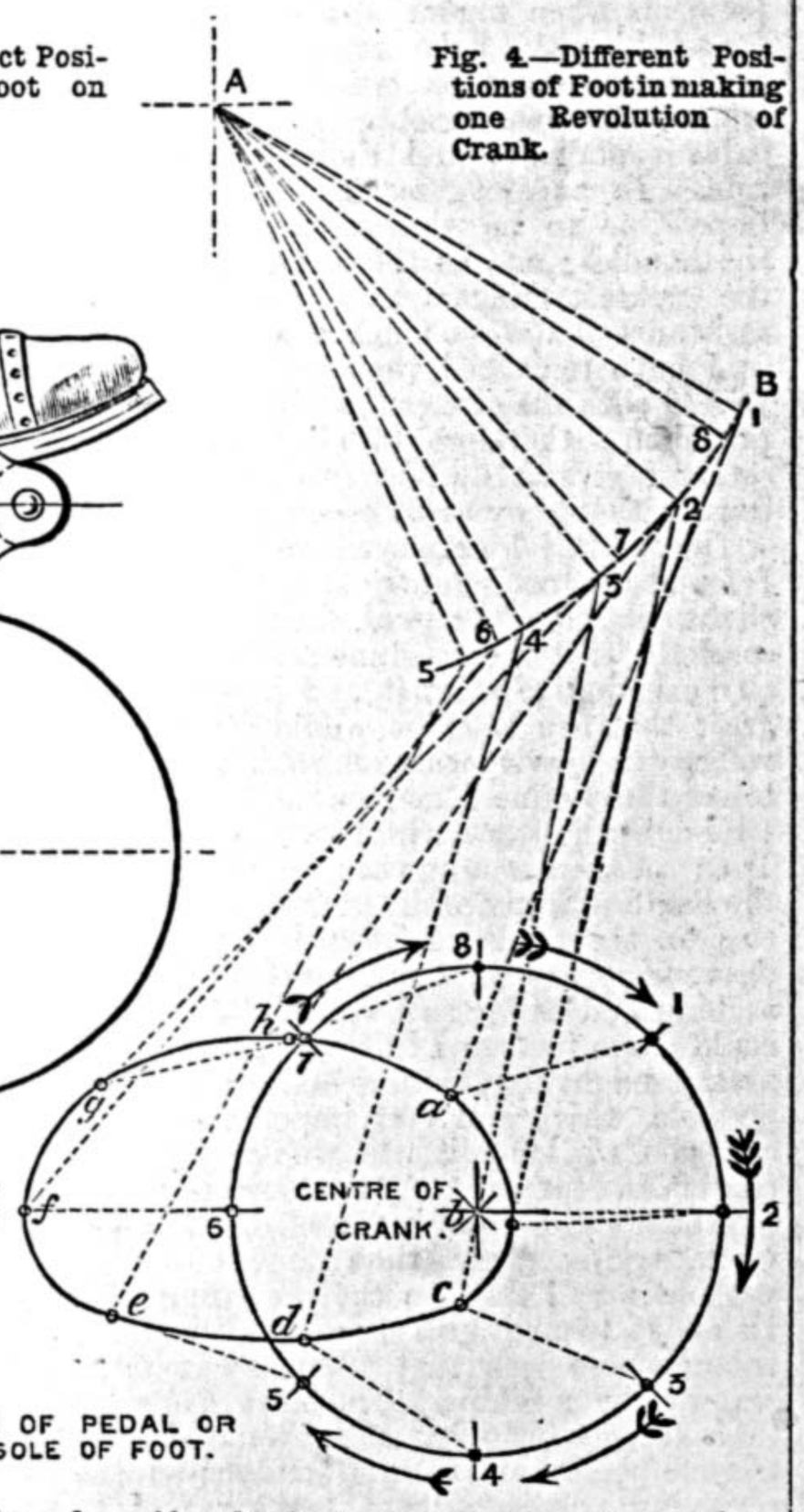


Fig. 4.—Different Positions of Foot in making one Revolution of Crank.

A FRAME WITH FOLDING DOORS FOR A CABINET PHOTOGRAPH.

BY J. W. GLEESON-WHITE.

To many owners of a cherished photograph there are reasons why it should not be always in evidence. It may be that the owner cares not to expose the similitude of one he loves to the gaze of every chance caller; it may be that it is a yet more sacred memory of a friend, who has joined

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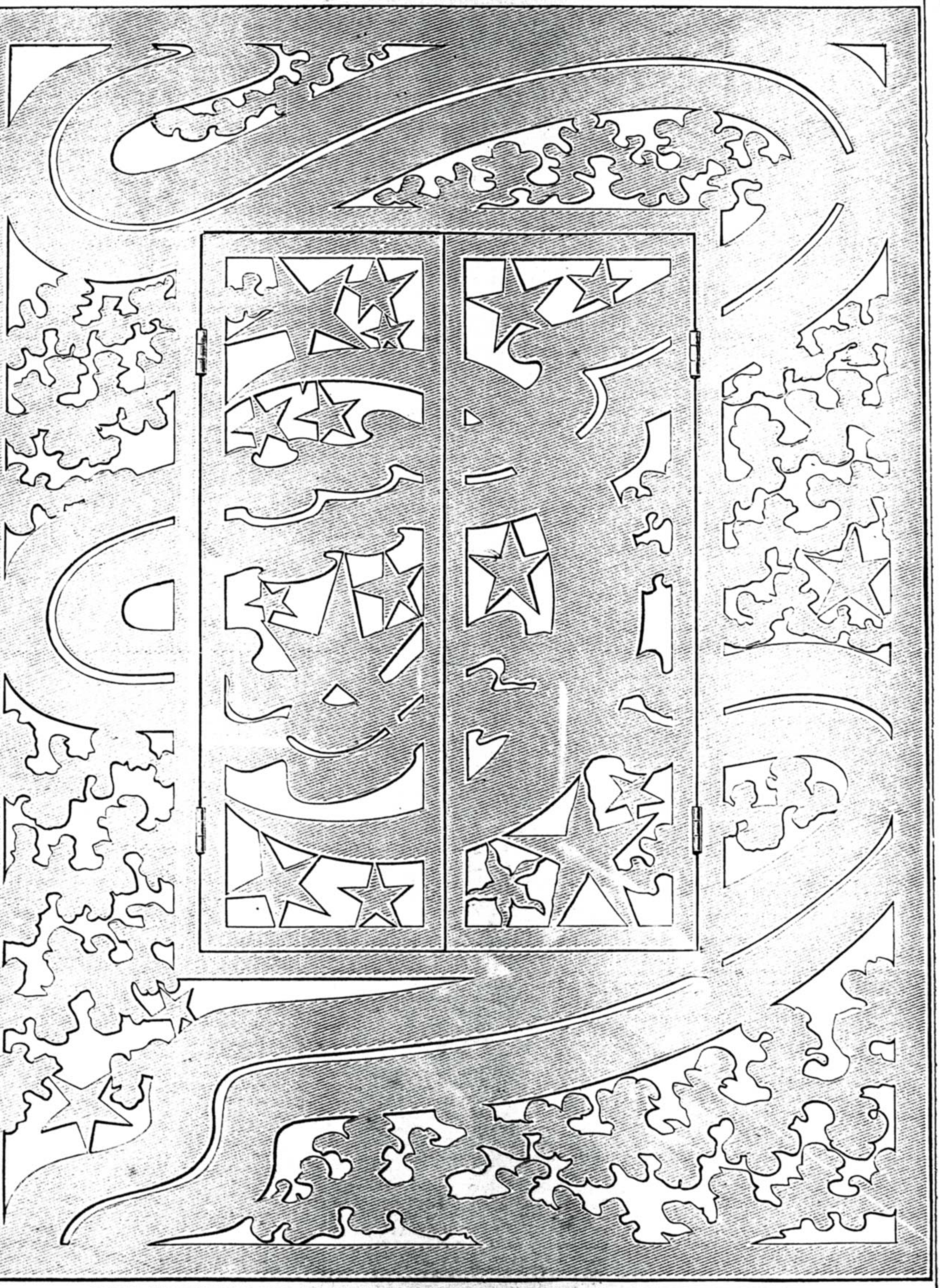

DESIGN IN FRETWORK FOR A FRAME WITH FOLDING DOORS TO TAKE A CABINET PHOTOGRAPH.

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the majority, that he hesitates to allow all to see; or it may also be that he wishes the silver print to be screened from the ultimately fatal light, that sooner or later dims the fair beauty of even the most perfect photograph. But whatever his reasons, a cabinet photograph frame, with folding doors to cover the enshrined picture, is always a popular article for fret-cutters to construct, and offers no difficulty in its subsequent finish to anyone the least familiar with tools.

The design chosen is a conventional representation of the sky, with the emblematical Giver of Life sweeping across it, clouds, moon, and star forms also being employed. This symbol of life has been frequently used in Oriental art, and has no great unfitness for the purpose to which it is now adapted.

If cut in brass or metal, the hingeing of the doors would offer some little obstacle, and it would be easier to employ very thin metal mounted on plain polished wood. This yields a more satisfactory result than mere metal, which has rather a mean appearance unmounted and worked in thin sheets.

It matters little whether the star forms are exactly the size given, nor is it important that the rays of each should be of uniform thickness and at equal angles.

It is not needful to describe the fret-cutting, that has been repeated here often enough already, but a few details not shown may require comment. Such a frame would be more lasting if backed completely with a thin piece of wood. By this plan the rabbet for the glass would also be easily managed. Take a plain piece of $\frac{1}{4}$ in. stuff the size of the whole—or $\frac{1}{4}$ in. less each way—and cut a square hole $\frac{1}{8}$ in. larger each way than the size of the two doors. Plane down the piece cut out to about half its thickness; upon the backing panel above the opening fix a strut, with hinge, to support the frame.

If cut in wood, the doors should be lined with silk or thin films of wood. The whole may be gilded in various bronzes, or the design itself worked on solid wood in gesso and finished in various shades of lacquer.

OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

83.—Air Stuffed Collars.

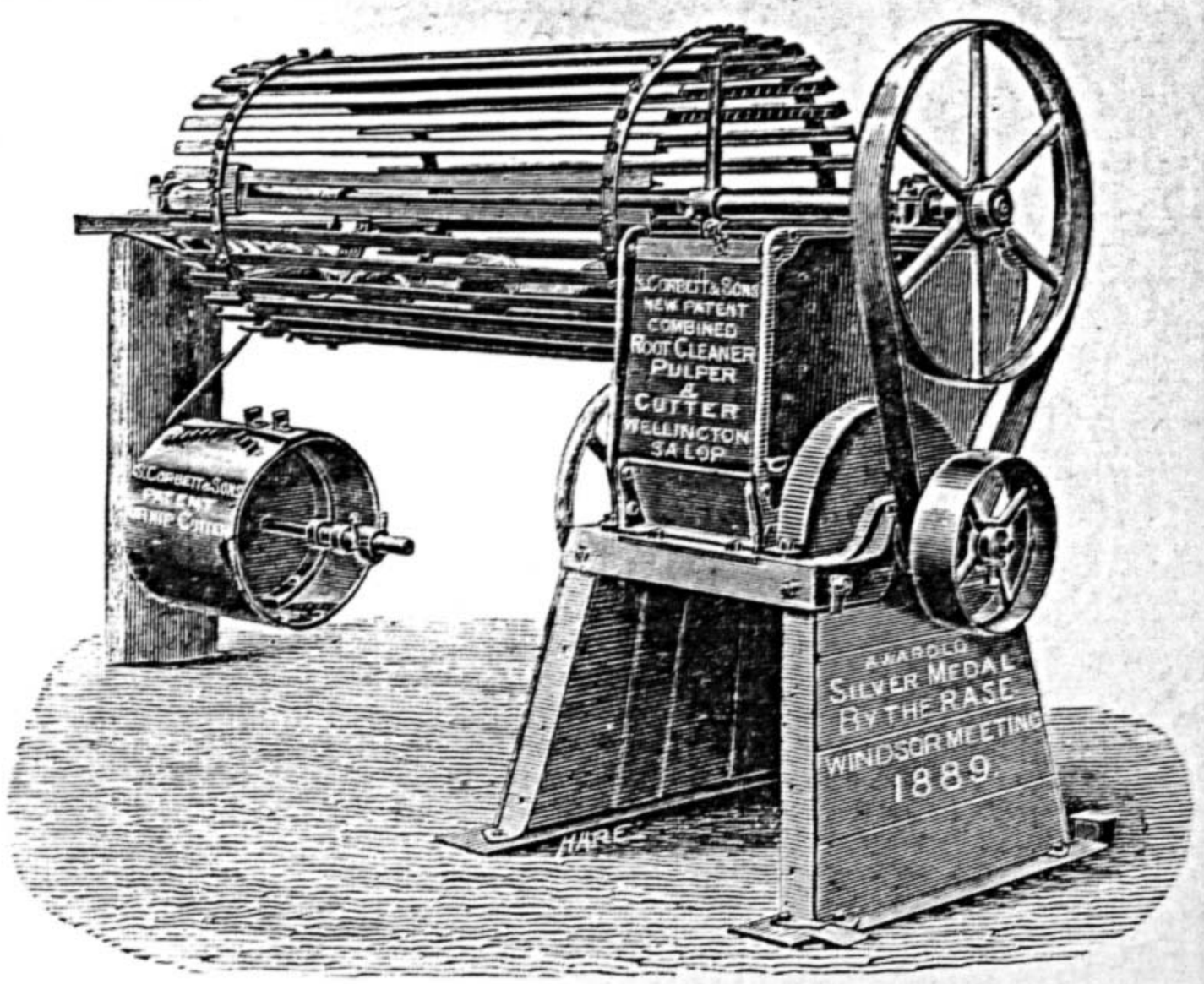
The omission of the aspirate to the word air is the only indication that the collars of horses are stuffed differently to the usual filling-in of the casing that takes the pressure of the "hames" for draft of horses. Air beds have long been known, cushions air filled are in common use, yet animal draft has been without that simple contrivance till recently.

The Alpha Air Horse-collar Company, Charing Cross Road/W.C., apply the same principle to pads for harness and saddle linings. The comfort of animals to have this yielding pressure on backs or shoulders must be great compared with the hard stuffing generally used in harness and saddlery. Trials under every variety of condition have proved the merit of this invention, and the economy must be coincident with it.

The utility of this invention is self-evident, and there will be no need to write more at length on the desirability of its general adoption.

84.—Corbett & Son's Patent Combined Root Cleaner, Slicer, Fingerer, and Pulper.

This handy agricultural machine, indispensable on large farms on which a large quantity of stock is kept and fed during the winter and early spring, is the patented invention of Messrs. S. Corbett & Son, makers of agricultural implements and machinery, Park Street Works, Wellington, Shropshire, and, now that autumn is already far advanced and winter pretty close upon us, cannot fail to be of interest to all readers of WORK who belong to the farm-keeping section of the community. The machine itself is shown in the accompanying illustration, which will afford a good idea of its appearance and purpose. It is driven by horse-power. The root-cleaning portion of the machine is the large horizontal cylindrical barrel, resembling a cage, to the left of the illustration, into which the roots are thrown from a hopper. The cylinder itself is about 5 feet 6 inches long and 2 feet 5 inches in diameter, and the bars are made of



Corbett & Son's Patent Combined Root Cleaner, Pulper, Fingerer, and Slicer.

T iron, the shaft or vertical part of the T projecting inwards, and notched or toothed along part of its length. As the cylinder revolves, the roots are thrown against each other and against the upright flanges of the bars, and are completely cleansed from all dirt and small stones that may have adhered to them when taken from the ground—as thoroughly, indeed, as if they had been washed in a root-washing machine, and this without the slightest injury to the roots. From the cleaner the roots pass either into the pulper, or fingerer and slicer, as may be desired, for separate barrels are supplied to effect these operations, which are easily changed by the adjustment of four screws, or removable altogether as a matter of course, so that the machine may be used simply as a root cleaner. The pulper barrel is composed of sectional plates, which may be of fine or coarse cut as required, and have the quality of durability, and can be removed and replaced at any time in a few moments. The cleanness of the roots prevents any chance of injury to the pulping and slicing arrangements. The fingerer and slicer, which, as well as the pulper, is rotated more rapidly than the cleaner, is shown to the left immediately below the cleaner. As a slicer it can be adjusted, as the word implies, to cut mangold or turnips, as the case may be, into broad slices, and as a fingerer to cut the slices into fingers of the width of $1\frac{1}{4}$ inches for bullocks, and of half this width for sheep. The knives are double-edged and reversible, and a new set can be introduced by any ordinary farm labourer, when required, so simple are the means of fixing them. The machines may be had with the cleaner cylinder to the left hand, as in the illustration, or to the right hand, as may best suit the convenience of the purchaser, so this should be mentioned when ordering. The power required to set the machine in motion is not great, but I am not aware that it can be driven by hand. The price of the root cleaner and pulper is £17 10s.; an extra charge of £2 7s. 6d. is made for the fingerer and slicer.

85.—A Few Practical Hints on Repoussé.

Mr. John Harrison, Art Metal Worker, 30, Augusta Street, Birmingham, sends a handy little book on "Chasing and Repoussé Work," with seven original designs for trays, bellows, photo frames, finger plates, vases, etc., and illustrations of the tools used, but the drawings are on a reduced scale, and must be enlarged to form full-size working drawings. Mr. Harrison supplies some brief but clear instructions for beginners in his "Elementary Hints," and in the letter accompanying his pamphlet says that he "shall be very pleased to give any information on the art apart from this manual." He names no price for his book, but this may be easily ascertained on application to Mr. Harrison himself.

86.—Messrs. Harger Bros.' Price List and Designs for "Rizaline" Cards.

Messrs. Harger Bros., Settle, Yorkshire, the well-known north country dealers in fretwork tools, machines, materials, and patterns, send me the latest edition of their price list, which contains a great variety of items of use and importance to amateurs. I may call attention to what, as far as I remember, are new specialities, namely, furniture and mantel nails, and ornamental bookshelf leather, in page 35, and the mouldings for picture frames in gold, black and gold, oak, and walnut, in pages 36 and 37, shown in full-size sections. Some additions appear to have been made to their fretwork patterns. The price of the price list is sixpence. A separate book is devoted to patterns of Messrs. Harger Bros.' "Rizaline" cards, which, as the term implies, have a surface very much resembling Chinese rice paper. Cards in "porceline" and "ivorine" are also supplied—all at very moderate rates.

The Editor.

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SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Boot Mending.—T. W. B. (*Ponder's End*) writes:—"One way of making an awkward job easy:—Get an upholsterer's needle, 8 in. (Fig. 1), put it in a handle (Fig. 2), fit your patch (Fig. 3), and make holes with awl if stout leather, such as kip—light leather will not want it, if you use the needle carefully. Pass needle with wax-end through, pull out needle, see that both ends are level, thread out side end, pass through second hole, pull out end inside boot, thread the inside end, pull out needle, draw both ends tight, and keep on till patch is finished. Work back a couple of stitches, cut off

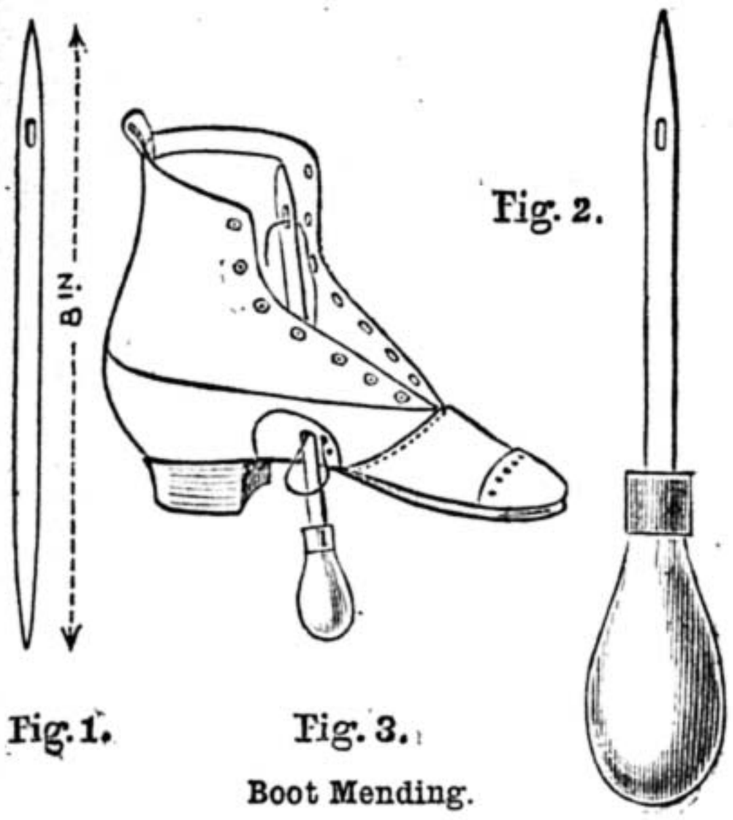


Fig. 1. Fig. 2. Fig. 3.

Boot Mending.

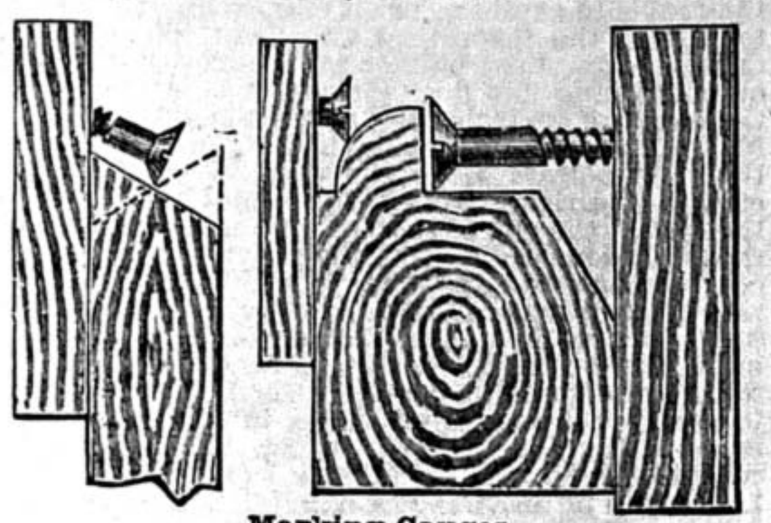
ends, and lightly tap with hammer to make it lay smooth. This, I think, will suit a good many people who cannot use the wax-end with bristles, as with the needle I can sew a patch on in a quarter the time I could with wax-ends. I hope this will be of use to some that mend their own boots, if you can find an odd corner for this. These needles are very little stouter than an ordinary stout awl."

Folding Chair.—J. D. (*Fairfield, near Manchester*) writes:—"*Re* W. C. W.'s comments (see Vol. II., page 455) upon folding chair, I for one shall be pleased if he will give sketch and dimensions of chair to fold flat, and to avoid the curved arms cut across the grain. I have already made a template of the chair; he questions the correctness of arm, and I will stop proceedings until his sketch and particulars appear."

A Coal Saver.—J. S. (*Oldham*) writes:—"Will J. W. B. (*Southport*) (see page 471, Vol. II.) give his address, and I will call and see his coal saver, as I don't fully understand the drawing? It seems to me a very good idea. I should be very much pleased to see it."

Carriage Cushions, etc.—AN OLD TRIMMER writes, in reference to W. P.'s answer to TRIMMER, (see page 436):—"The writer seems to have omitted a paragraph explaining how patterns, as diamonds, squares, etc., are formed in carriage trimmings, which is done as follows:—The size of the diamond, say, is decided upon. The cloth is folded in pleats and ironed on the back; this ensures the diamond forms being true and smooth in the crease; the button holes, where marked, are mostly strengthened by pasting on an inside patch of muslin at those parts, and the cloth is strengthened by a backing of glazed muslin; a layer of cotton wadding comes next, and the horse-hair on that; this is all done on a temporary frame at the bench independent of the main backing of buckram for squabs, etc. The rule for the quantity of horse-hair for a squab, is: for light stuffing, lay on the squab as much horse-hair as will stand up eight inches; for fuller stuffing, twelve inches in height; both give nice elastic squabs. For high raised diamonds they are each stuffed separately between the cloth and the 'backing;' but this is not usual in carriage work unless for very hard wear."

Makeshift Marking Gauges.—E. W. (*Peckham*) writes:—"In WORK, Vol. I., page 540, a simple bead router was shown by J. M. E. It may interest many readers to know that marking gauges may also be made the same way. With two screws a very serviceable makeshift mortice gauge can be made, whilst an extension of the principle gives us multiply tooth gauges. In multiply tooth gauges so made, it is best not to have the screws in line, but ranged in a curve, so that not more than two



Marking Gauges.

screws can mark at one time. These screw gauges are often preferable to those of orthodox pattern, and may frequently be applied where the others could not be used. A few suggestive positions are shown in the accompanying illustrations; no explanation is needed."

II.—Questions Answered by Editor and Staff.

Work on Marbling.—T. R. (*Paisley*).—If you will apply to the publishers of Van der Burg's work on marbling, namely, Messrs. Crosby Lockwood & Co., Stationers' Hall Court, Ludgate Hill, London, E.C., they will give you all necessary information as to price, etc.

Painting Brasswork.—F. T. C. (*Bristol*).—Macpherson's Foochow Enamel, which, I daresay, will answer your purpose. A special kind is made for metal work.

Taking out a Patent.—W. D. (*Collyhurst*).—An article appeared in WORK, No. 35, which would be of use to you.

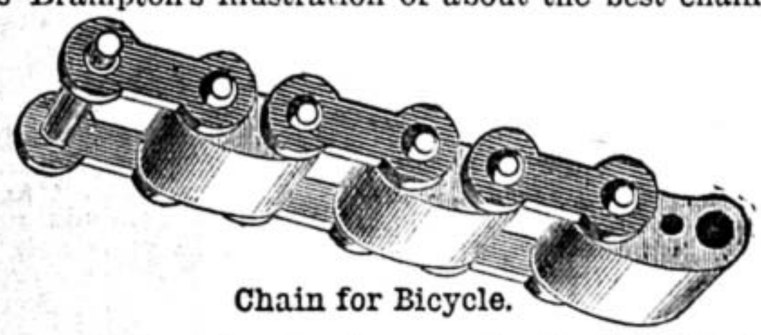
Warn's Book on Tin-plate Working.—A. T. S. (*New Swindon*) writes to ask if TINKER will tell him where he may be able to get this work (see WORK, Vol. II., page 355).

Cutting Spirals in Wood.—CARINO.—The spirals often seen in wood turning are seldom done by turning—properly so called. There are two ways of making a spiral cut round a cylinder, or a screw thread, which may be regarded as an inclined line wound round a cylinder. These two ways are (1) to cause the work to move to and fro in the line of centres: this is done in a lathe with a traversing mandrel; (2) to cause the tool to move from right to left (generally, but not always) as the work revolves between fixed centres. In the first case the screw or spiral is limited to the pitch (or distance of threads) of the model screws fitted to the lathe mandrel; in the second case, the pitch of screw or spiral depends on the relative speed of the traverse of the tool and rotation of the work: for instance, if we ensure 1 in. travel of tool from right to left to each rotation of the work in the lathe, then we have 1 in. from centre of each cut to centre of next, or 1 in. pitch; the relative speed of movement is determined by change wheels, having cogs, which, though interchangeable, are various in number of teeth and in diameter. The work done by these two methods and other expedients of similar nature are usually of too fine a pitch to be useful in wood turning, and in such articles as pillars for whatnots, balusters, candlesticks, and stands. A process of hand-cutting is adopted which, though it is not turning, is yet done on the lathe—that is, while the work which has been turned remains on the lathe. If a band of paper the width of the desired strand is wound round the work in a spiral direction, leaving the wood uncovered between each turn of the paper as much as the width of groove is intended to be, a little gum or glue will fix the paper temporarily, and the band being removed from the driving wheel, the left hand can govern the mandrel while the right cuts to the desired depth in the uncovered space between the coils of paper: first with a saw, then with gouges, and lastly with rasps and glass-paper. This is easier to do than would appear from the description, though necessary brevity forbids a fuller explanation. If a double twist is desired, let CARINO—at all events, at first—use two bands of paper, both the same width but of different colours, being careful to leave a space for the cut-out portion and to begin exactly opposite each other; but practise a single twist first. The obstacle to doing this work by ordinary lathe appliances is the rapidity of traverse required, and the necessity of swift motion in wood-turning, though the writer has seen an appliance which he was informed was for twist pillars of bedsteads only.—B. A. B.

Acids for Electro-plating.—F. W. (*Kensington*).—I think I understand what you want, although you have not clearly expressed your wishes. You cannot make the *acids* used in electro-plating and gilding, nor do you wish to know how to make them, although this is the gist of your question. You evidently want to know how to make up the liquids used by electro-platers and gilders, when they dip, say, a copper coin into a silvering bath and it comes out looking like silver, and then dip it into the gilding bath and it comes out coated with gold. Ah! my friend, there is a little conjuring done behind the scenes, of which you know little or nothing. If I were to tell you here how to make up the liquids for silvering and gilding you would not be able to silver or gild them because you would not know how to work them. I should have to explain the whole art of electro-plating to you, and this could not be done in the limited space at my disposal. I hope to be able to tell you and other readers of WORK, very soon, how to silver and gild a few trinkets.—G. E. B.

Solution for Silver-plating.—J. C. R. (*London, S.W.*).—To make up one gallon of silver-plating solution, suitable for plating a few small brass articles, procure 5 ounces of silver nitrate, costing about 3s. 6d. an ounce; ¼ lb. of potassium cyanide, costing about 1s.; and 2 or 3 gallons of rain water. Dissolve the silver nitrate in ½ gallon of the water, and 2 ounces of the cyanide in 1 quart of water. Add the cyanide solution to the nitrate solution in small quantities at a time, and stir well with a glass rod each time. White curds of silver cyanide will form and sink to the bottom of the vessel with each addition of cyanide, whilst any silver nitrate remains in the solution. When these become scanty, add the cyanide still more carefully and stir up the curds well after each addition of cyanide. Cease adding cyanide when this ceases to cause a white cloud in the solution and appears to pass clear through it. Allow the white precipitate to settle well down; then carefully decant off all the liquid above, and again fill up with rain water. Allow this to settle; then pour off as before, and give the precipitate of silver cyanide a third washing in a similar manner. To this wet silver cyanide add the remainder of the potassium cyanide dissolved in 1 quart of water, and stir all well together. If the cyanide employed is pure, the quantity given will throw down the silver as silver cyanide, and dissolve this to form the double cyanide of silver and potassium solution. But as this is not easily obtained, it will be advisable to have a few extra ounces of the cyanide, and add some of this in small quantities at a time until all the silver cyanide has been dissolved. This done, filter out any dirt there may be by passing the solution through a calico filter, and dilute the whole to form 1 gallon of plating solution. Now add 1 ounce of potassium cyanide, and work the solution with two cells of a Smee or a Daniell battery, employing a sheet of pure silver as an anode. I presume, from your letter, that you know how to prepare the articles for plating, to manage the process, and to finish the articles when plated. Should you meet with any difficulties, write again, and I will try to help you over them.—G. E. B.

Chain for Bicycle.—CYCLIST.—The sketch given is Brampton's illustration of about the best chain



Chain for Bicycle.

going of 1 in. pitch to fit same wheel as Appleby's chain, new hard steel block chain No. 4. Address—F. Brampton & Co., Oliver Street, Birmingham.—A. S. P.

Frosted Glass: How to Imitate.—D. S. (*Aberdeen*).—The kind of glass frosting which I expect you wish to imitate can only be executed at the glass manufactories, the principal and most successful processes being a part of the manufacture of the glass itself. However, here are some:—Roll up tolerably tight a piece of tin 8 in. long and 2 in. broad, or use a small flat piece of marble. Dip either of these in Croydon or glass-cutter's sand, moistened with water; rub over the glass, whether flat or round, dipping it frequently in a pail or pan of clear water. This is the method employed for frosting jugs, etc. For lamp glasses a wire brush is used, and they are chucked in a lathe. Large pieces of glass should be laid on a bed of baize or other soft material. If the frosting is to be very fine, finish with washed emery and water. As a temporary frosting for windows, mix together a strong hot solution of sulphate of magnesia (Epsom salts) and a clear solution of gum arabic, and apply warm. Or use a strong solution of sulphate of sodium (Glauber's salts) warm; when cool, wash with gum water to protect the surface from being scratched.—H. L. B.

Parkinson's Gas Burner.—A READER of "WORK."—The address, Messrs. G. J. Parkinson and Co., Birmingham, is full enough, and, indeed, the fullest address I can give you. Correspondents must kindly note that I invariably give addresses as far as I know them in "Our Guide to Good Things," and that they should always write to the address given.

"Electricity in the Service of Man."—OSWALDSTREE.—A new edition of "Electricity in the Service of Man," in one vol., price 9s., will be published in a few days by Messrs. Cassell & Co.; it can then be had by order of any bookseller.

Incubator.—J. M. J. (*Belfast*).—In answer to this subscriber I wish to say—(1) the drawer containing the eggs is under the tank, or source of

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heat. In the older incubators this was not always secured, but glue-pots or similar vessels having water in the outer pot, and the eggs laid in sand in the inner pot, have been used, but as the animal heat of the hen is applied above the eggs, we ought to imitate the natural process as closely as possible. (2) A paraffin lamp is better than most other lamps, as its heating power is greater than many others; moreover, paraffin is cheap, and in a three weeks' consumption spirit of wine or other liquid fuels of a costly character would be rather expensive. (3) The lamp must be outside the incubator in order to obtain air and to allow the fumes to escape; the effects of combustion are, obviously, bad for the eggs from which you expect the chicks. (4) This is difficult to answer, as you do not give full particulars of your partially made incubator. If the pipe is a flue for the lamp, then make it of tin plate, about 1 in. in diameter, say 3½ in. in circumference, well soldered; if the pipe mentioned is for the hot water to pass through, ½ in. gas compo tubing will answer well. (5) It will be well to have the top of the case movable, but as it cannot often need to be removed, you can fasten it with wood screws. You would do well to get the Index to Vol. I., and obtain each number that contains any information on the subject. Always, in asking information on any work in progress, tell our Editor where you are, how you have hitherto proceeded, and where the difficulty has arisen. Much better information could then be given than is possible when the querist gives so scanty information. This exhortation may be universally applied. —B. A. B.

Safety Machines.—T. W. (*Birmingham*).—There will in all probability be a series of papers on making a safety machine of the "Diamond" type in Vol. III., but Vol. II. is already too far advanced, and so much has to be completed therein that I cannot undertake to commence and finish any new series of nine or ten papers within its limits.

Sea Diving.—T. W. (*Birmingham*).—As far as I can see, you can only become a sea-diver by associating yourself with a man who is already a diver by calling, and going through a regular course of instruction and practice under his directions.

Address.—J. H. (*Redcar*) asks for the address of Messrs Macintosh & Co., Limited, of Cambridge Street, Manchester (see also my reply in "Shop" to A. S. (*Musselburgh*), No. 83, page 504. At the time of writing on the subject of shoes for crutches, I was not at all sure that this firm, after a lapse of many years, still made these useful articles. I therefore wrote, and received a reply stating that they will be happy to supply WORK readers with them at the price of 7s. 6d. per dozen—cash with order, of course.—J. W. H.

Telephone.—W. B. (*London, W.*).—The article on the Telephone appeared in WORK, No. 28, page 439. There is also a book published at 5s. by Trübner & Co., Ludgate Hill, on the same subject, by Du Moncel.

Powdered Glass.—FISHPONDS.—The powdered glass for frosting Christmas cards must be very fine; you could get it of nearly any glass blower, and a small quantity would go a long way. Do you not know of any glass-blowing works in your neighbourhood? This would save the cost of carriage; if not, write to London to Messrs. J. Powell & Sons, Whitefriars Glass Works, Temple Street, and say what you require it for.—W. E. D., JUN.

Glass Bottles.—H. G. (*Oxon*).—I do not think an address has been given for glass bottles; I cannot find it; one was asked for, but I do not see any reply; however, here are the addresses of two glass manufacturers, either of which I think will suit you:—Mr. G. Fletcher, Bottle Manufacturer, Walmgate, York; Messrs. J. Powell & Sons, Whitefriars Glass Works, Temple Street, London. —W. E. D., JUN.

Patenting Inventions.—E. C. M. (*Ipswich*).—Advice has been already given to inventors who seek to become patentees in various parts of WORK, for which see Index to Vol. I., published at 1d., for reference to papers in the body of WORK, and comments, etc., in "Shop." I cannot lend assistance in forming clubs of would-be patentees. If you have a sufficient number of friends to join you, why not follow the directions given in the newspaper cutting of which you speak?

Silk Winder.—W. P. (*Dartford*).—I regret that I cannot see my way to making a model of the silk winder I described in No. 76 of WORK, for your benefit: it would open up too large a field of possibilities. It is not very hard, however, to make one for yourself. The lower wheel drives a smaller one by means of a band, and the silk is wound on a little frame attached to the top. This frame may be a simple card or the form I described. If you begin at the beginning, following carefully each direction, there ought not to be much difficulty in the matter. I hope you will succeed.—APIS.

Tyre Indiarubber.—S. B. E. (*No address*).—Your correspondent wishes to do an impracticable thing. There is no simple method of making a tyre out of a lump of rubber, the simplest process involving expensive plant, as well as practical knowledge. In other words, it can only be done in a rubber manufactory. It would be about as practicable for S. B. E., out of a solid nugget of steel, to make a hollow backbone for his bicycle. S. B. E.'s plan is to give the lump of rubber to a rubber manufacturer and get value for it in tyres.—A. S. P.

Camber of Girder.—J. M. E. (*Openshaw*).—J. M. E. does not state what kind of girder he means, whether a wooden turned girder or an iron lattice girder, such as is used in bridge work. From the dimensions given I should presume it is the latter. A girder 60 in. by 7 in. by 7 in. is a largish job for one who does know how to give it the requisite camber; but it may be he only wishes to possess the theoretical knowledge of how it is done. A practical builder would draw with chalk on a drawing loft floor (precisely as is done with the frame of an iron ship) half the length, namely, 30 ft. of the girder of the full height; he would draw the main bottom beam, showing the camber by a curved line rising from a horizontal line, showing the 4 in. at the end of the 30 ft., then he would show the top beam parallel with the lower, then he would connect the two by as many uprights as he thought necessary, after which he would fill in the panels (thus formed) by the lattice work, then he would mark every rivet hole, showing how the whole was to be riveted together. After this the carpenter or joiner would come and make templates of thin wood to fit this full-size drawing. These templates would be in two or three pieces, as a frame 30 ft. by 7 ft. would be unwieldy to handle. In any case the frames, when put together, would cover the drawing exactly, and on these frames every rivet hole on the drawing would be marked. The iron workers would now use these frames in cutting the various plates and bars, and in punching or boring them for the rivets. It will be obvious that the same templates or frames, by turning them over, will serve for the other half of the girder, and the whole 60 ft. when riveted up will show whatever amount of camber has been given to it in the preliminary drawing. If the girder was a wooden one the operation would be entirely different. The lower beam would be pulled upwards in the centre, and at other necessary points by tie rods. The uprights are called king or queen posts; all the angular pieces, going from corner in the panels, are struts; all the pulling parts, which must be of iron, are ties. —A. S. P.

Silvering Glass.—B. J. (*Port Talbot*).—I am glad you were not too much discouraged to write, we are always glad to help. The only reason why readers are sometimes referred back is that it seems unfair, when so many are waiting for answers, to take up the space with replies exactly the same as what appeared a short time before; however, as it happens, I do not think your question has been answered before, for in the postscript you casually remark that you are in the glass trade and want information professionally; most of the letters did not say anything, and so I concluded they were written by amateurs, and of course what would do for the former would not be suitable for the latter. To silver plate glass you will require tinfoil, mercury (quicksilver), roller for smoothing the foil, and a silvering stone—this is a large slab of slate or marble, very carefully prepared, perfectly level and smooth, and mounted upon a swivel. Take a piece of plate glass, clean it very carefully, or you will have your work all to do over again, as the slightest speck or mark shows perfectly plain when laid upon the tinfoil and mercury; even with the greatest care you may have to take the glass off once or twice before it is successful. Unroll a piece of tinfoil, which is sold in lengths of about 6 ft., and from about 1 ft. to 3 ft. in width, to allow of it being cut to the best advantage (I believe larger sizes can be had to order), and cut about ½ in. or 1 in. larger all round than the glass; smooth out all the creases, and pour on the mercury; put plenty on, as the greater part is recovered; now slide the glass along the prepared foil, pushing out all the air bubbles and dirt, etc.; this will require a little practice to do well. You will now see if the glass is clean; if not, it must be removed at once before the foil has adhered; if perfect, weight down so as to squeeze as much of the mercury out as possible, and leave for a few hours, according to the size of your piece, tilting up your stone at the same time slightly. When the weights are removed, block one end up with wood, placing a piece of foil at the lower end, and let it remain as long, or even longer, than before; then stand upon a shelf or on the floor, and leave until the foil has adhered perfectly. For small glasses, crown glass is sometimes employed; if this is used you will see you cannot weight down like plate glass; you can use a board for this instead of a stone, and it is usual to do several at one time, and as each piece of glass is slightly curved, silver on the hollow side, and place one on top of the other, so as to squeeze out the mercury. Proceed in the same way as for plate glass, only when the foil is ready do not slide the glass on, but lay a clean piece of white paper on and the glass on the paper, then, with a quick motion, draw the latter away, leaving the glass resting on the foil and mercury. I hope I have made everything clear, but if not, or if there is anything else you want to know, write again, and you may feel assured we will do our best for you.—W. E. D., JUN.

Spood China.—A. B. (*Yoxford*).—It is impossible to give you a correct idea of the value of an old "spood" china service without seeing it, especially as you do not say the colour of the pattern (I suppose it would be blue?). So many things must be considered in valuing old china—the pattern, the colour, the condition, etc.—so that if a price was named simply from a description it would only mislead you most likely; if only a single piece was seen, an expert would soon tell you the value. Have you no one close by you could show it to? I may say "spood" does not rank very high in value in the market. If you do not succeed write again, and I may be able to recommend you to someone in your neighbourhood, or in some way to help you if you were willing to incur a little expense in sending a plate.—W. E. D., JUN.

Fretwork.—FRET CUTTER.—Try the local ironmongers. You might get what you require from either of the following places in Glasgow:—Mac Kellar, 468, Gallogate; J. F. Fergusson, Maxwell Road, Lamb & Crawford, 295, Shields Road; or at J. and A. Stewart, Kelvinhaag Street. If you cannot get what you require at any of these, write to L. Marshall, 14 and 15, St. James's Street, Old Street, E.C., who can forward you one per parcels post.—A. J. H.

Wood Drying.—E. H. G. (*London, S.E.*).—If you mean by your inquiry, "How can you dry firewood?" there is only one method—*i.e.*, by stacking it so that the air can pass through the pile. Of course you are aware that white deal does not burn so readily as yellow, and if rotten will char.—A. J. H.

Electrical Engineering.—A WOULD-BE-ELECTRICIAN.—The only course open to yourself, and those like you who are already in some employment but have limited means, is to continue in your present employment and devote your leisure to a study of the subject, with a view to the practical application of the theories committed to memory from text books. It would have been better had you brought the youthful vigour of the young brain to bear on the subject, but at the age of twenty-three you are not too old to begin. Many men, occupying prominent positions in the profession, commenced later in life than yourself. If you are in the vicinity of science classes, held in the evenings, attend them and get a good elementary grounding in magnetism and electricity. At the same time, put the theoretical knowledge thus obtained into practice by making electrical apparatus and experiments at home. Whilst studying the elementary part of the subject decide which branch you will take up as a means to obtaining a livelihood in the future, and give this your closest attention. The lower rungs of the ladder are occupied by electric bell fitters, telephone and telegraph linesmen, engine and machine minders, men in charge of electric light installations, and electro-platers. You will probably have to enter the ranks of one of these branches when the opportunity occurs, and work your way up to an official position by sheer force of brain and muscular power. Your path would have been easier could you have afforded the fee charged for tuition at one of the schools of electrical engineering, as there you would at once be placed in a position to obtain an insight into the construction and working of electrical instruments and machines, and you could from these have testimonials as to your ability. But much can be done by you if you will study the best books on the subject, and go to work with the full determination to overcome all obstacles placed across your path. I shall always be willing to advise you should you get in a tight corner; but my advice now is to *work* yourself out of any fix you may get into, if possible.—G. E. B.

Gold Plating.—SULPHO-CYANIDE.—The full and correct details of the art of electro-deposition cannot be compressed into the columns of "Shop." There are several good books published on the subject, and some of these have been repeatedly mentioned in WORK. It is my intention to write out a few papers on the subject for publication in this journal, when I can spare time enough for the purpose. If you cannot wait for these, get Mr. Watt's book on "Electro-deposition," or the book by Mr. Gore on "Electro-metallurgy." Either of these will tell you all you wish to know of the art. —G. E. B.

Cure of Disease by Electricity.—D. McG. (*Renton*).—Questions relating to the cure of diseases by means of electricity should be addressed to the Medical Editor of *Cassell's Saturday Journal*. In WORK we will gladly advise you respecting the construction or repair of any electrical apparatus, whether used for curative or other purposes; but we cannot advise you in the application of such apparatus to the cure of diseases. This, we are assured, can only be effectively done by a qualified surgeon. Amateur attempts at curing diseases by such means as these may result in serious injury instead of cure.—G. E. B.

Circular Saw.—J. McD. (*Glasgow*).—I might put you in the way of fixing up a small circular saw bench, but am afraid after it is fixed and set to work that in a short time you would be like many I know who have started to work a small circular saw by hand power—wished they had never fixed it, and resort to the old way of ripping with the hand saw. It must be understood that to despatch work with a circular saw, it has to be driven at a high speed, and unless there is some power different from hand power, there cannot be a great amount of work turned out. A man may commence to turn at a fair speed, but he soon becomes tired, when the speed decreases, and the saw becomes a mere drag. To drive a circular saw is not work for man or ass—at least, that is my opinion, and I have had no little experience; and I am of opinion—in fact, I am almost sure—that for the work you have to do, if you go to work the right way, you may turn out more work with the hand rip saw than with a small circular saw driven by hand. You may say, "What do you mean?" I mean that many a man will take a hand saw

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and commence to cross-cut his stuff the length required, then he will take the same saw and try to rip his stuff with it, but he finds he makes slow progress and very bad work; then he will go and, after a fashion, sharpen the saw, thinking the mistake is in the sharpening, at the same time not knowing where the fault is. After he has finished the so-called sharpening, he commences to rip again, but the saw, if anything, runs worse than before, and there is an amount of trouble to put a straight cut in the board. As you have to cross-cut and rip your boards, you should, in the first place, get two good hand saws—one for cross-cutting, the other for ripping—and if you are not acquainted with or do not understand saw sharpening, put your saws into the hands of a practical man, telling him at the same time the kind of work you chiefly have to do with them; then if he knows his work he will know how to proceed. When your saws are ready, line one board the width you want it and place it square on another board, as your stuff is not very thick, and rip away the two at one time; then mark them for cross-cutting, placing one board on the other as before, and cross-cut the two, or even three if you wish, at once, which the saw should cut easily if in good condition. And when the saws get dull, if you do not understand the sharpening, give them to the saw sharpener; do not begrudge a sixpence; it will more than pay you in the long run. If after reading the above you still would like to fix up a small circular saw bench, I would refer you to Vol. I., No. 28, page 446 of WORK, where you will see how to make a circular saw bench, also instructions how to drive off a small circular saw. I might add that for some time past a small circular saw bench has been advertised in this paper by Lewis & Lewis; how it answers I cannot say, as I have not seen it at work. I have no doubt, should you write to the above makers, that they would send you full information in reference to it.—A. R.

Monogram on Desk Nameplate.—SECOND-HAND.—With regard to the monogram you wish to remove from the brass nameplate on your desk, you may erase it. Procure a 6 or 8 in. flat smooth-cut file; heat it to a dullish red; place in the vice with lead or copper clams, and bend the end to a gentle curve, to give clearance to the handle while using. Re-heat to a cherry red, and quench in *clean* cold water, say half a gallon, into which put a handful of common salt; this will make the file very hard, but if you handle carefully it will last your job well, and the probability is that you may never want it for a similar purpose. Now with your bent file (or riffler, as it is termed by the users) proceed to file the surface of the nameplate equally all over, until the last deepest cut is taken out; afterwards rub with pumice stone and water, next with Tam-o'Shanter hone, and lastly with putty powder (oxide of tin), applied dry, with a piece of leather. Now all this seems very simple, if you can avoid rubbing the plate into holes, as the natural tendency is to erase the objectionable letters first. Try to avoid this, and rub well outside the monogram first, and then smooth over equally. The best plan (for desk nameplates are very thin) is to get a piece of sheet brass $\frac{1}{16}$ in. thick, and file it out to the shape of the original nameplate, but $\frac{1}{8}$ in. larger; have the new plate engraved, and take it to a cabinet maker to be inlaid, who will finish up the surface equal to new.—N. M.

Cycle Enamel.—BIKER wishes to know how to make an enamel for cycles for baking on. I would strongly advise you not to attempt anything of the kind, as, unless you make very large quantities, it will not pay you. If you only want a gallon or so, why not buy it of some first-class maker, and save all chances of failure, as well as trouble? You can get an excellent stoving enamel from Palmer, of Old Street, E.C., at 2s. per pint. Why don't you enamel your cycles in the same manner as a lot in the market? The following is the way, and about half the cost of the stoving process:—Thoroughly clean all parts to be enamelled, and see that they are perfectly free from oil or grease. Pass all parts through smoke of fire or forge, until they become thoroughly dull. Rub all loose soot off with a piece of dry rag. Next procure some good spirit enamel and carefully paint cycle with same. On no account go over the same part twice, and always in the same direction. Always paint a machine in a well-lighted room, as darkness causes the enamel to dry clouded and dull. Harris & Son, Beech Street, Barbican, sell an enamel at 9d. per pint, well suited for this process. You will find this an excellent substitute for baking, and the cost and trouble cannot be compared with the stoving process. Write and let me know how you get on, and I will help you over any difficulty, should any occur.—F. C. P.

Self-acting Fountain.—READER.—A complete design for a self-acting fountain appeared in WORK a few weeks ago; you could adapt the features to any size.—C. M. W.

Fountain.—T. B. (*Dover*).—It is evident beyond doubt that you have not carried out the instructions as to self-acting fountain correctly, either in making or using, I cannot, of course, say which; look them over again carefully; it cannot help playing if correct. I may add that another correspondent writes, "Have just finished my fountain, and it looks so well and works so satisfactorily that I and all who see it are quite delighted with it."—C. M. W.

A Child's Cot.—MRS. G. H. (*Walton-on-Thames*).—Mr. E. Bonney Steyne has left this country for a short sojourn in the States; but when WORK reaches him and he sees that you wish for a child's cot, "the top, bottom, and sides to be made something the same as the first tier in the 'Overmantel in Arabian Style,' the arches to be made of a different kind of wood to that which would take the place of glass, or one with some inlaying in the panels, to be French polished," I am sure he will use his best endeavours to meet your wishes.

Folding Chair.—A. A. (*Richmond*).—On account of its associations, there is very good reason for you to prize the wood you possess, which you say was brought from Cabul by a partaker in the last Afghan war. My only regret is that every soldier in that war (and in any other, for the matter of that) did not bring home some trophy or another, for then it would have been evidence that none had lost their lives. War is a dreadful slaughterer, but talking of it will not, alas! prevent it, so let us return to a peaceful subject. I think that concerning chairs (either folding or otherwise), or anything for bodily accommodation, given dimensions are almost useless, although I have sometimes given them. It is true that such articles sold in shops are always all of one size, but in our "Shop" we must study comfort. You can buy ready-made clothes, or you can have clothes made to order—which is the best course? Proceed upon the plan mentioned by Mr. G. Le Brun lately. It is a curious fact that I have used the same method

Fig. 3. Fig. 5. Fig. 4. Fig. 2. Fig. 1. Fig. 6.

Folding Chair and Parts.

for two or three years, when designing any new folding chairs, showing that the same ideas occur to several persons as being most preferable. Get some wooden laths a few feet in length, and place two of them crosswise. By shifting them along each other you will find the most convenient spot to pivot them together, and the best width to have the rails; and when this is done you will be in a position to decide the most preferable lengths for the back and front legs. I am well acquainted with the chair of which you speak, and I have drawn it here with an improvement or two. In order not to entail too much labour, I have intended that the seat shall be merely a rather thin board with rounded corners. It could, of course, be a mortised and tenoned framing, strengthened by corner triangular blocks screwed and glued inside, and upholstered (of which latter operation I cannot speak here). The top would be morticed and tenoned (Fig. 3), the mortice being in the top; and if you take my advice you will have a head-rest, as I show. Under the top join a rather wide rail, on to which tack a cushion. To fasten the leather arm straps, drive a long screw partly through a turned knob, then through a hole in the strap, and into the top of the front leg (Fig. 5), afterwards filling up the hole in the knob with a piece of wood. The strap should be twisted and the lower end of it screwed or pivoted to the under side of the seat, while the top portion of it should be treated similarly in connection with the back leg. If you have a hook (Fig. 6) in the back legs, and holes in that part of each strap, you could adjust the chair to various inclinations. Fix the seat so that an inch or so projects at the back, and on to it tack the lower end of a piece of stair carpet, or other material; tack the other end of the latter in the same manner to the top rail. Have a cushion for the seat, and either tack it to the latter or stitch it to the back carpet. You must have the back long enough to allow the chair to fold, for the longer the distance between A and C (Fig. 2), the greater the distance between A and B increases during the folding. Connect cross spindles as in Fig. 4. For material you might use a cretonne cushion for seat, and cretonne stitched to canvas for the back.—J. S.

Horizontal Coupled Engine.—J. D. (*Glasgow*).—Your engine is evidently altogether wrong. I want further particulars to determine the horse-power. I suppose the cylinder which is not working is disconnected from the shaft, but you do not say so. The cut-off should be the same at both ends. The valve gear must be wrongly set to give different cut-offs at opposite ends, and, unless you have a very heavy fly-wheel, I should expect the machine to be shaken to pieces very shortly. In one, say, outward stroke you cut off at $\frac{1}{3}$ and on the return stroke at $\frac{1}{4}$. You must set the valves to cut off equally in bold strokes. Then take an indicator diagram to give you the mean pressure. Multiply the mean pressure in pounds per square inch by the area of piston, 154 square inches, by the stroke and twice the number of revolutions per minute, thus—

$$154 \times 2{\cdot}5(\text{feet}) \times 2 \times 58 = 44{,}660 \text{ ft. lbs.}$$

of work per lb. pressure per square inch on piston. One horse-power is 33,000 lbs. per minute. Therefore for each mean lb. pressure per square inch the horse-power will be $\frac{44{,}660}{33{,}000} = 1{\cdot}353$. This multiplied by the mean pressure will give the horse-power in the cylinder—the deductions for friction will depend upon the connections. I shall be glad to answer further questions on this subject. There is a second edition of "Details of Machinery," published by Messrs. Lockwood & Sons, London.—F. C.

Repolishing Plates of Gas Engine.—ONE IN TROUBLE.—If your slide valve, cover, or plate is cut, through working without oil, take them off of engine and clean them of oil; then rub a fine flat file over the surfaces so as to remove any parts that may be standing above the surface, but be careful not to scratch the face; wipe them clean of dust, and oil them all over, and replace them. Should the slide leak after this so that the gases in the cylinder do not fire, the best thing you can do is to send them to the makers to have them refaced, as special tools are required, and experience to do this properly.—S.

Telephone.—MAC.—The back number of WORK—*i.e.*, No. 28—containing article on "The Speaking Telephone and the Microphone," can be had for 1d. through any bookseller or newsagent, or from Cassell & Co., Limited, post free, for 1½d.

Phonograph Screw.—MECHANIC.—Your question is rather a strange one. You say, "Please tell me, per 'Shop,' the smallest diameter a piece of steel could be 20 in. long to be turned from end to end without vibrating." Well, I am not a turner, so I cannot tell you; but suppose I could and did, what benefit would the information be to you? The information which you really want, I think, is of what diameter should you make the shaft for a phonograph. Haven't I guessed aright? If so, my answer is, get ¾ steel rod, and you will find that will answer your requirements, and you need not make the screw so fine, it is not necessary. I hope this will help you.—W. D.

Photos on Wood.—PHOTO.—The plan most usually adopted is the transfer of a carbon print to the surface—this is the most satisfactory method; every precaution has to be taken to prevent the block warping by only moistening the surface just enough to perform the operation. Another plan, preferred by some, is to coat the surface with salted gelatine (very little gelatine) and sensitise in an ammonia nitrate bath 60 gr. to the ounce; dry and print by contact; tone and fix. The wood should be prepared firstly by a coating of fine zinc white or a weak solution of gelatine, to which a little chrome alum has been added, and dry in the light. The principal thing to be borne in mind is to leave as *little substance* on the surface of the wood as possible, and only allow the *surface* to come in contact with moisture. The blocks must be set edgeways to dry, and as much moisture removed by smooth blotting-paper as possible. Whatever process is adopted, a certain amount of practice is required to perform the operation neatly; the beginner had better experiment on some worthless blocks to begin with.—D.

Plaster Mould from an Engraved Spoon.—E. M. (*Barnstaple*).—I am sorry that E. M. does not tell more fully the purpose for which he requires the plaster moulds from his spoons; whether for electrotyping or otherwise. If he were more explicit, I could give him fuller information. Possibly some other moulding material might be better than plaster; though there is no reason why, with care, he should not get a good impression from it. Let him first have his metal spoon quite clean and dry, and then give it a thin but uniform coat of olive oil. The plaster used should be superfine, it should be mixed as thick as cream, and first brushed over the metal with a camel-hair brush, so as to ensure every delicate marking of the engraving being filled; the remaining plaster can then be poured

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on, and the mould brought to the required thickness. Of course, only one-half of the thickness of the spoon will be moulded at once. When the first half has set, say in ten minutes, trim the mould with a knife; brush it over with clay-water to prevent sticking, and mould the second half upon it. If carefully done, there will be no difficulty either in separating the two halves of the mould or the spoon from the plaster.—M M.

Varnishing Leather Work.—J. G. (*Kirkdale*).—The shops at which the materials for fancy leather work are sold also supply varnish, either pale or coloured, with more or less umber, so as to give imitations of dark wood; they also supply a stiffening composition to brush over the leaves, etc., before varnishing. This last may be made with orange shellac 6 oz., Australian red gum 2 oz., and spirits of wine ½ pint; put in a bottle together and shake occasionally. This is applied with a camel-hair brush. If J. G. wants a varnish which will colour his leather less than those ordinarily sold, let him put 3 oz. of gum dammer in a bottle with ¼ pint of turpentine; and when the gum is dissolved strain to free the solution of possible impurities. If too thick, more turps can be added; if too thin, more gum. Absorption must first be stopped by sizing over the leather with isinglass dissolved in water, and the varnish afterwards put on with a hog-hair brush.—S. W.

Painting Portland Cement.—J. K. (*Durham*).—The cause of the paint coming off is most probably owing to the cement not having been thoroughly dry when the first coat was laid on, although it might appear dry; this will have partially stopped the pores, and prevented all the moisture from coming out; or the paint may not have had a sufficient quantity of driers mixed with it; or the cement or the sand with which it is mixed may contain some ingredient that prevents the paint drying properly. If the cement is hard and clear of cracks or blisters, you may conclude it is right. If soft or cracked you will have to take it off, and replaster it, using clean, sharp sand, and the best cement. If the cement is good I should advise you to let it stand till next summer, in order to give it time to dry, then after two or three weeks of hot dry weather, give it two or three coats of good oil paint. You had better get a painter to mix it for you, telling him the purpose you want it for, so that he can make it quick drying paint. It should not have had less than four months to dry in before the first painting, and more if the weather was wet. In first coating cement work with paint, if the cement is properly dry, the paint sinks in nearly as fast as it is laid on.—M.

Eminent Electricians.—F. W. (*Hinckley*).—The Institution of Electrical Engineers, whose office is at 4, The Sanctuary, Westminster, S.W., has on its list 3 honorary members, 175 foreign members, 429 members, 880 associates, and 109 students, making in all a membership of 1,596. As it is probable that all the 429 English members are eminent in some one branch or other of this wide-reaching profession, and scarcely any can claim the eminence of being masters of it, I think it would be an invidious task to single out four of them and mark their names as most eminent. You will find the full list in Berly's "Electrical Directory for 1890," price 6s. Respecting the religious opinions of scientific men, I do not greatly concern myself. Good men are found professing belief in a variety of creeds. I do not think it is within the province of WORK to inquire into and publish the religious opinions of electricians.—G. E. B.

Wood for Packing-cases.—TINNER (*Hebden Bridge*).—The best wood for cases is spruce or white deal, not because no other wood will do so well—as, of course, yellow deal or pine will do—but it is impossible to obtain high prices for packing-cases, and white deal or spruce answers every purpose at a much lower rate. Where it is possible, have the width of the case and the depth (if advisable), so that a certain number of boards join up to the required breadth. Much may be done in this way by a judicious selection of deals and battens, which should both be always kept in stock by the packing-case maker. TINNER, no doubt, knows that deals are 9 in. in width and battens usually 7 in.; but the item may be news to some younger reader. The ends of cases may, with advantage, be made of stouter stuff than the sides, and it is usual and judicious to make any joints that are in the sides and ends *not* coincident—in other words, to borrow a bricklayer's term, "to break joint." Management will usually effect this without extra work; but in any case it is wise to give attention to the point. In a case I made yesterday two 9 in. boards formed each side. I cut each end out of two 9 in. boards, one of which was cut down the centre and joined—thus, 4½ in., 9 in., 4½ in.; by this means an effective "break joint" is afforded at the cost of a little sawing and two shot joints; sometimes the same effect can be produced without any extra work. Some shippers—perhaps all—will not receive cases without iron hooping round ends—that is, they will not sign receipt, "in good condition," consequently I always put iron bands round all cases to go by sea. As to lining, I, a woodworker, cannot hope to give advice to a tinner, though I always line my cases myself with zinc, and find no difficulty in turning up the lining. The best plan I know is a tinman's bench with its iron straightedge along the front; but I am obliged to do without even that, and use a wooden mallet and a straight-edged piece of wood. If I wanted any other appliance I think I should consult Mr. Alexander, of WORK; but for the few I do I find very simple tools sufficient. This is the only reply I can make when asked to give "*any information on packing-case making.*" The word "any" is very indefinite, and I expect that I have told TINNER what he knows, and missed the difficulty which he has found. Many regrets.—B. A. B.

Pepper's Ghost.—GHOST.—The necessary instruction, with diagrams for rigging up a "fit up" for the optical illusion known as "Pepper's Ghost," would take up at least two pages of "Shop," so I will not attempt it here. I will, however, write a special article on the subject should the Editor wish it; and as a nephew of Professor Pepper—who is now in England—I may say I know a little about the subject. The magic lantern is of no use in this particular case, but the limelight is used, worked with a theatrical limelight box. I could include, however, in such article, instructions "How to raise a Ghost by the aid of a Magic Lantern." Domestic bereavement has prevented me contributing any articles for some time, but I hope soon to be at work again. Cassell & Co. also publish a book on Pepper's Ghost, price 1s.

Glass Tube.—S. R. (*Newry*).—To fuse and close a glass tube such as you describe, you will require a blowpipe flame of some sort; but with this the job is a simple one. Apply the flame to the part of the tube you wish to bend or close, and when at a white heat you will find little difficulty in hoisting the tube so as to close it effectually. Referring to your second question, the spirit lamp of which you send sketch is one of the most ordinary kind; you may burn spirits of wine or methylated spirit in it.—OPIFEX.

Gravestone Letters.—R. F. S. (*Sunderland*).—Fill the letters with molten lead, which will last for years.—C.

Work on Steam Engine.—JUNIOR DRAUGHTSMAN.—Thank you for your suggestion. I will look into it.—ED.

Organ Building.—CONSTANT READER.—The following books deal with this subject:—Dickson's "Practical Organ Building," 2s. 6d., Lockwood and Co.; Wicks' "Organ Building," 3s. 6d., Ward, Lock and Co.—C.

Materials for Polishing Brasswork.—JACKO (*Tottenham*) can obtain all materials for brass polishing, including Trent sand and Sheffield lime, from Messrs. E. Gray & Son, 47, Clerkenwell Green, London, E.C. Either of the above can be had in small quantities of 7 lb. for 1s., or 10s. per cwt.—C. A. P.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Weighing Machine.—M. N. W. (*Wells*) writes: "I have a weighing machine for weighing coals, etc., registered to weigh six tons, made in 1832 by John Hutchison, Sheffield. The platform seems to have been bolted to a wooden frame. The frame is gone; would some of your correspondents tell me how to make a frame and set the machine up? I have no doubt some of them have seen this class of machine in working order. A rough sketch would oblige."

Collieries.—W. G. (*Dudley*) writes:—"I should be glad if any readers would tell me the names of some of the principal collieries in South Wales, and also which is a good newspaper circulating in South Wales for advertising."

Wood Carving.—A BEGINNER asks:—"Can anyone tell me the best and most reasonable place near London to get the wood, tools, and patterns for wood carving?"

Ointment Boxes (Wood Pulp, Wood, or Metal).—ÆON writes:—"I should like to know manufacturers of above—particularly wood pulp—or particulars of how made."

Sound Conductors or Reflectors.—J. H. E. (*West Kensington*) writes:—"Will readers kindly mention a few of the best materials both for conducting and throwing back sound-waves, and in the order of their conductivity or otherwise, both metals and woods of different kinds, and plastic materials? The information is desired with regard to aids for the deaf mainly."

Bell-shaped Vessels.—EXPERIMENT writes:—"Will any of your readers inform me what is the cheapest and most rapid way of making a quantity of bell-shaped vessels, about three or four inches deep, of mild Bessemer steel or brass sheet of 18 or 19 gauge, what sort of tools are required, and where they may be obtained?"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—B. B. S. (*Portadown*); A. G. (*Rathgar*); P. H. (*Pendlebury*); AQUA; T. S. C. (*Birmingham*); E. T. (*Bolton*); C. H. (*Old Charlton*); E. D. (*Liverpool*); A. J. E. (*Edenbridge*); W. J. W. (*Whitehouse*); B. L. S. (*Richmond Hill*); G. and M. M. (*Glasgow*); W. P. B. (*Southport*); G. E. (*Oswestry*); H. A. (*Birmingham*); J. W. T. (*Birmingham*); T. E. D. (*Northampton*); J. B. (*Westminster*); AMATEUR BELL FITTER; E. R. (*Crouch End*); FISHER: NERO; A. W. G. (*London, W.*); J. T. V. (*Durham*); AMATEUR; E. J. B. (*Chesterfield*); W. S.; NO NAME (*Kidderminster*); R. L. (*Glasgow*); J. C. (*Aberdeen*); CONWAY; ELECTRIC; F. T. (*Plymouth*); E. C. (*London, W.*); C. H. (*Gateshead*); STEEL WORKER; F. S. C. (*Birmingham*); E. T. (*Lancashire*); CRISPIN; A. G. (*Dublin*); DITTON; STUDENT; C. A. B.; J. J. M. (*Ashton-under-Lyne*); AN AMATEUR; W. E. (*Birmingham*); C. M. (*Gloucester*); A. E. S. (*Maidstone*); E. W. (*Colchester*); J. N. (*London, E.*); E. B. (*Liverpool*); W. E. W. (*Brixton*); E. R. (*Crouch End*); W. R. (*Wood Green*); TELEPHONIST; H. B. (*Brixton*); AN OLD SUBSCRIBER; GYPSUM; E. E. (*London, S.E.*); FOGGED; JOUST; H. O. B. (*Peckham*); AMATEUR (*Halifax*); F. L.; AMATEUR CARVER; D. B. D. (*Glasgow*); E. H. (*Manchester*); LITTLE JOE; IMPROVER.

IMPORTANT TO INVENTORS AND DESIGNERS.

"WORK" EXHIBITION.

THE Proprietors of WORK are gratified to be able to announce that under the PATENTS, DESIGNS, AND TRADE MARKS ACT, 1883, they have applied to, and been granted by, the Board of Trade, a CERTIFICATE, as required by the Act cited, that the WORK Exhibition is an Industrial Exhibition, as defined by the Act, and that therefore any exhibitor, on giving notice to the Registrar of Patents, Southampton Buildings, shall be entitled to protection for any design or invention which is not the subject, as yet, of any application for Provisional Protection or of any Registration of Design.

Notice is therefore now given that the time specified for the receipt of applications for space, previously fixed for October 30th, will now be extended to November 15th, in order to enable inventors and designers to take advantage fully of this privilege.

JOHN WHITFIELD HARLAND, Secretary.

La Belle Sauvage,
Ludgate Hill, E.C. October 31, 1890.

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Castings for Microscopes; parts, finished instruments, etc. Illustrated list, 3d.—BUTLER BROS., Benthal Road, South Hackney, London. [15

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Elliptical Chuck, as page 468, WORK.—If sufficient demand exists, BRITANNIA CO., Colchester, will supply parts, either rough or machined, at a moderate price. [11 R

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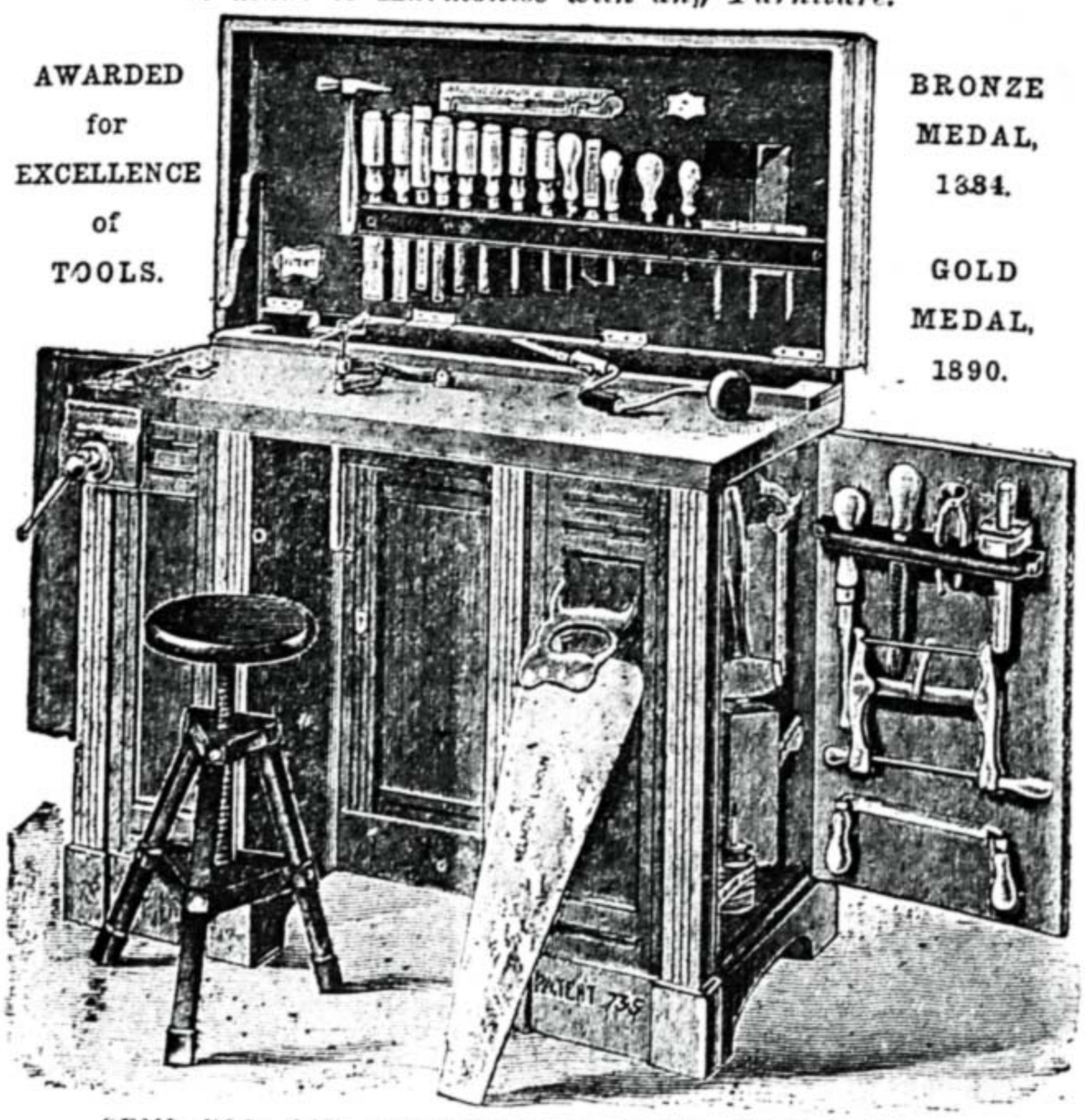

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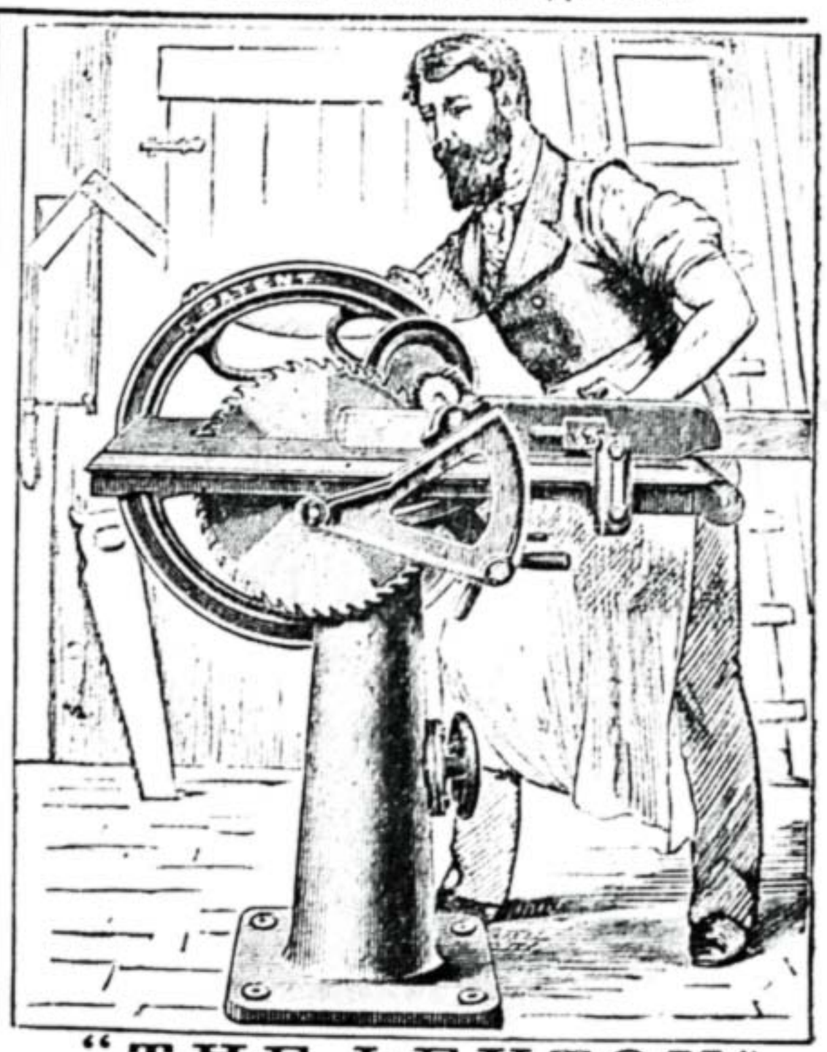

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